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Profiling Transit Ridership

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November 2000

CUTA Mission Statement

CUTA is the association of providers of urban transit services, suppliers and related organizations in Canada. Its mission is to promote the role of urban transit in enhancing mobility, and to support its members in the fulfilment of their mandate.

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Abstract

The transit industry has a range of information requirements related to ridership. These include in particular the need to identify those people who will be most likely to ride improved transit services and to guide market research activities so as to improve our understanding of the needs, characteristics and opinions of existing and potential riders. Ridership profile information is also required to support "image building" or "promotional" objectives. This report considers alternative ways of describing transit's customers (and potential customers) in order to improve transit planning, marketing and policy-making. The project included 3 major tasks: 1) a Literature Review which considered traditional transit industry "attitude surveys" and related studies, as well reports and data produced as part of transportation modelling studies conducted starting in the late 1950's; 2) the development of "Rider Typologies" based on the literature review; and 3) Synthesis and Reporting.

This report describes "what we know about transit's customers," outlines a suggested approach to stratification, and discusses the service planning and marketing implications of the findings. It also makes recommendations related to data collection and analysis and related research issues. The report also contains in the Appendix a detailed review of various studies that provide alternative approaches to the profiling of transit's customers.

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Appendix B **Profiling Transit's Customers – Alternative Approaches: A Working Paper**

1.0 Introduction

This report explores different perspectives on transit's customers based on a selective review of transportation and transit research undertaken since the late 1950s and the assessment of potentially relevant market research approaches.

The consideration of alternative ways of profiling or describing transit's customers and potential customers is driven by the need to improve planning, marketing and policy-making related to urban public transportation in Canada. The transit industry has a range of information requirements related to ridership. These include the need to identify those people who will be most likely to ride improved transit services and to guide market research activities so as to improve our understanding of the needs, characteristics and opinions of existing and potential riders. Ridership profile information is also required to support "image building" or "promotional" objectives.

The project workplan included 3 phases or major tasks:

1. **Literature Review** with reference to the CUTA, APTA, ITE, and UITP resources and an Internet search of other relevant databases. The references considered included traditional transit industry "attitude surveys" and related studies, as well reports and data produced as part of transportation modelling studies conducted starting in the late 1950's. Appendix A lists the reports that were referred to as part of this project.

2. **Develop Rider Typologies** in consultation with CUTA staff and prepare working paper. The literature review findings with respect to profiling and the proposed rider typologies are documented in Appendix B, "Profiling Transit's Customers – Alternative Approaches Working Paper."

3. **Synthesis and Reporting** using a report outline developed in consultation with CUTA staff including the preparation of draft and final reports.

2.0 Approaches to Profiling Transit's Customers

The transportation and transit literature that was reviewed can be considered in terms of four different perspectives or approaches:

a. **Transportation Demand Modelling Perspectives** as documented in transportation modelling reports and studies documenting related O-D survey data analysis. This perspective provides some insights into who has used transit since the 1950's in North America and into the definition of "transit captive" and "choice" sub-markets.

b. **CUTA Social Trends Profiles** based on socio-demographic segmentation considering employment status (worker, student, other), age and gender. This approach was intended to more fully exploit data that had been collected to support urban transportation planning (O-D Surveys) in Canadian cities.

c. **Traditional Transit Industry "Attitude Survey" Approaches** which typically segment riders into simple classes based on frequency of use (e.g. riders/non-riders, light, medium, heavy, heavy-heavy) and then profile each segment considering attitudes and socio-demographic attributes.

d. **Market Opportunity Analysis** as documented in *"Market Opportunity Analysis for Short-Range Public Transportation Planning - Method and Demonstration"* (NCHRP Project 8-16) NCHRP report 212 (September 1981) and described as a "...descriptive, comprehensive, planning method...for the application of market opportunity analysis to the planning of short-range public transportation."

Two alternative generic strategies for characterizing customers were also identified that are potentially applicable to urban public transit:

- **Geodemographic Analysis or "Clustering" Methods** have been pioneered in Canada by Compusearch. Clustering techniques have been applied to a broad range of market research applications. They allow companies to focus their marketing efforts at specific areas or on specific groups of customers who are more likely to use a particular product or service.

- **One to one marketing strategies**[1] are a further elaboration of the idea that marketing should be focused on people who are likely to buy a specific product or service. This approach, which emerged in the early 1990s, recognizes "...that 80% of any companies business comes from 20% of its customers."[2] One to one marketing takes advantage of developing technologies to direct marketing efforts at individuals rather than groups defined geographically (as per geodemographics). The airline industry has pioneered marketing approaches that focus on that industry's best customers – the frequent flyers.

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[1] See Don Peppers and Martha Rogers, August 1993, The One to One Future – Building Relationships One Customer at a Time, Doubleday, New York.

[2] Peppers and Rogers, p. 108

3.0 Synthesis and Conclusions

Based on the review of the literature, as documented in Appendix B, there are two different but related perspectives on transit riders that are useful in the context of this project. The first looks at transit riders in the context of total travel, the O-D Survey Perspective, whereas the second focuses on the segmentation (or classification) of transit users, the Attitude Survey Perspective. In this context the CUTA Social Trends approach to profiling is an extension of the demand modelling or O-D Survey perspective. It was concluded that the Market Opportunity Analysis approach did not offer any advantages over the other two and it is not considered further. However, elements of the "clustering" and "one to one" approaches to profiling market segments are discussed where they are potentially relevant.

3.1 O-D Survey Perspective

The first perspective builds on the availability of large scale Origin-Destination (O-D) surveys that are comparable over time and are available for different cities. Typically, 5% of area households are interviewed as part of these surveys and high response rates (70% or more) are achieved by pre-notification, and co-ordinated follow-up procedures. The O-D surveys collect travel data for all household members within sample households, focusing on the previous weekday.

Transportation modelling research based on O-D surveys has provided the concepts and terminology that describes transit travel and transit's share of the overall urban travel market (referred to transit's "mode split"). From this perspective travel is understood in terms of trip purpose, time of travel, trip length and the mode or modes used, and transit users have been described as "captive" or "choice".

The O-D perspective has attempted to identify the factors that influence mode choice (between auto and transit), and despite the limitations of the underlying data, has shed some important light on "mode choice" decisions for those riders who have a choice.

Demand modellers started with the most basic distinctions between captive and choice riders based on auto access. The analysis of O-D survey data showed that trip makers could be classified as auto captives, (need their cars for work or personal reasons), transit captives (no car available or cannot drive) or choice riders (have car available but can use transit). Experience suggests that transit captivity may not be an appropriate term – it would be better to think of persons who do not drive or do not have access to a car, as "passenger captives." While they may not be able to driver their own vehicles, they are not necessarily captive to transit – they can walk, arrange a ride with family, friends of co-workers, or decide not to travel.

The Central Business District (CBD) - The Main Destination for Choice Riders

This early literature suggested that most choice transit riders were travelling to downtown, while passenger captives accounted for most other riders. Therefore, early demand modellers tended to classify transit users at being either CBD workers, students or others (a large residual category of persons that accounted for relatively few transit trips).[3]

Given the importance of the CBD as the major transit destination, and the area that attracts "choice riders", transit trips to this area were often estimated separately in the early days of travel demand forecasting.[4] Transit use in the 1950's was observed to generally decline with auto availability and distance from the CBD. It was also observed to decline as the travel time ratio (travel time by transit divided by the travel time by auto) increased.[5] Where transit time was less than or equal to time by auto, mode splits as high as 60% to 75% were observed in the CBDs of major U.S. cities.

The Importance of Individual "Cost" Factors

The perceived value of the various activities and costs associated with using transit has been a major issue for mode split forecasting and has important implications for assessing alternative transit service strategies. Each transit trip typically involves walking to a transit stop, waiting for the bus or train to arrive, travelling on one or more transit vehicles (in-vehicle time), transferring time (if more than one transit vehicle is used) and walking from transit to the final destination. The consensus of demand modellers is that walking time to and from transit is 2 to 3 times more onerous than in-vehicle travel time in relation to the perceived total cost of using transit. If the weight applied to in-vehicle time is 1.0, the weight applied to access time is 2.0 to 3.0 or more.[6] The comparable values for waiting and/transfer times range from 1.5 to 2.0.

For the auto mode, the walk time to/from parking is similarly weighted as being 2 to 3 times more onerous than in-vehicle times. Parking cost and availability are important "cost" factors that influence mode choice by raising the cost and reducing the convenience of the auto mode. Transit's competitive position for

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[3] Martin, Memmott and Bone, Principles and Technique of Predicting Future Travel Demand for Urban Area Transportation, MIT Report No. 3, June 1961.

[4] See Louis E. Keefer, "Characteristics of Captive and Choice Transit Trips in the Pittsburgh Metropolitan Area." paper presented to the 41st Annual Meeting of the Highway Research Board. 1962.

[5] Martin, Memmot and Bone, 1961, pp 117-118.

[6] Stephan Algers and Staffan Widlert in "The Applicability and Stability of Logit Models in Sweden – Some Recent Findings and Policy Implications," Behavioural Research for Transport Policy, VNU Science Press, pp 173-192, report that the relative weights for in-vehicle time, walk time to parking or bus stop and waiting and transfer times are: 1.0, 3.2, and 1.6.

travel downtown reflects a combination of expensive and/or inconvenient parking and high levels of transit service.

In most demand models, the total cost of using transit is estimated by adding the values of the various cost components, all expressed in terms of time or dollars. Verron and Martens question the assumption that these values add up to a total figure that reflects the total perceived "cost" of using transit. Instead, they suggest that transportation options are perceived and evaluated as "entireties." This research demonstrates that combinations of favourable ratings, such as good access to transit at both trip ends and a direct public transit link between origin and destination results in a higher probability of using transit than the sum of the individual additive effects (adding the value of walk, wait and in-vehicle times). Whereas the combined effects of access and connectivity are estimated to increase the probability of transit use by 18%, for example, the individual effects of access and connectivity total to only 12%.[7]

This approach to understanding mode split also points to the potential importance of factors like weather protection (at transfer locations) for public transport use, when other factors are favourable. For example, whereas the summation of the individual ratings on weather projection, access and egress walk times, and transfer waiting times suggests a 13% change (from auto to transit), the actual combined effect of favourable rating on all of these factors was a 24% shift to transit.

Verron and Martens' research confirms the importance of reducing walk and waiting times and the number of transfers in encouraging choice riders to use transit. However, their findings suggest that strategies that focus exclusively on reducing in-vehicle times will fail. Effective transit service strategies must seek to develop a combination of favourable conditions recognizing the importance of access, connectivity and comfort/amenity factors.

The Role of Transit Service Levels

Implicit in most mode split modelling research is the assumption that changes in transit service will result in short-term behavioural changes -- add new express bus services or rapid transit and people will stop driving and start riding. Shalaby and Steuart[8] question this premise based on research carried out using O-D survey data for the City of Toronto.[9] They conclude that once the various socio-demographic factors that explain travel behaviour are accounted for (such as auto access) variations in transit service levels do not appear to explain observed

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[7] Hedwig Verron and Gerd Martens, "Users Reactions to Specific Combinations of Policy Measures" in Behavioural Research for Transport Policy, VNU Science Press, 1986, pp 144-145.
[8] Amer S. Shalaby and Gerald N. Steuart, "Trip End Mode Split", in Transportation Research Record 1556, 1997.
[9] This research compares the explanatory power of trip end and trip-interchange mode split models calibrated to 1986 TTS data for choice commuters living and working in Toronto.

variations in transit mode splits for travel to areas outside the Downtown. This research highlights the importance of longer term locational and auto ownership decisions for observed transit mode choice. Decisions on where to live and where to work require the consideration of transportation issues including auto ownership and mode choice. This is not to say that transit service levels are not important to short-term decision making in situations where travellers are offered a transit option that is competitive in terms of convenience, travel time and cost. At present, competitive transit services tend to be limited to the Downtowns or CBDs of Canadian cities.

Socio-Demographic Factors and Mode Choice

The CUTA study entitled **"The Implications of Demographic and Socio-Economic Trends for Urban Transit in Canada"** employed a market segmentation approach based on age, gender and employment status (worker, students and all others) to compare variations in daily trip rates by mode for nine Canadian cities taking advantage of comparable O-D survey data.[10] This approach describes differences in transit and total trip rates (daily trips per day) and demonstrates the unique socio-demographic attributes of transit trip makers.

The CUTA study highlights the relationship between age and mobility and the comparatively high use of transit by persons aged 15-24 and by women of all ages. Exhibit 1 illustrates how total trip making is highest for the 35-44 age group while transit use generally peaks for the 15-24 cohort.

While women are less mobile than men (have lower daily total vehicular trip rates) they are transit's best customers, accounting for between 56% and 68% of weekday transit trips ten cities that were studied.[11] Women have higher transit trip rates for all age groups but lower total trip rates. The observed differences in trip making appear to reflect differences in driver's licensing and auto access.

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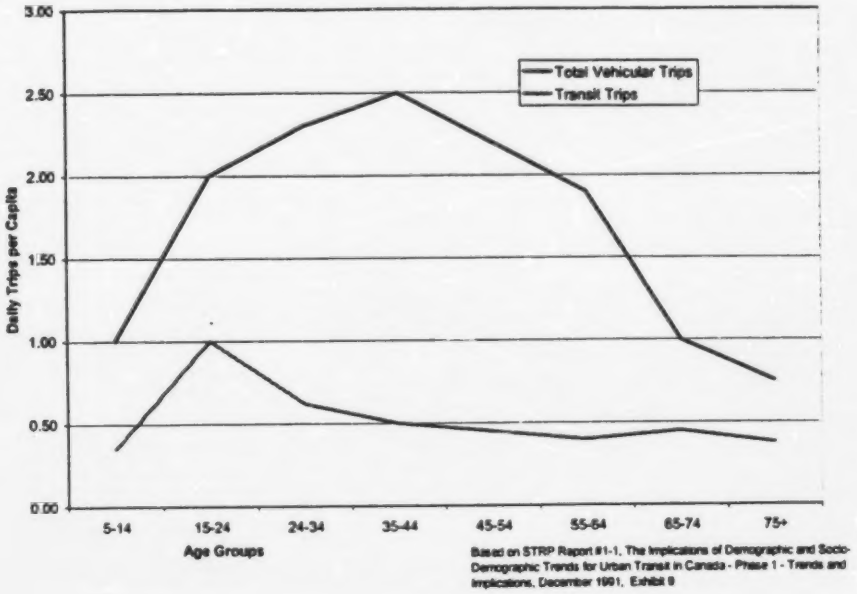
[10] See STRP Report #1-1, The Implications of Demographic and Socio-Demographic Trends for Urban Transit in Canada: Phase 1 Trends and Implications, December 1991, Prepared for the Canadian Urban Transit Association by Tranplan Associates and Environics Research Group Limited.

[11] See STRP Report #1-1, The Implications of Demographic and Socio-Demographic Trends for Urban Transit in Canada: Phase 1 Trends and Implications, page 15, December 1991, Prepared for the Canadian Urban Transit Association by Tranplan Associates and Environics Research Group Limited.

Exhibit 1 - Mobility, Transit Use and Age



Based on STRP Report #1-1, The Implications of Demographic and Socio-Demographic Trends for Urban Transit in Canada - Phase 1 - Trends and Implications, December 1991, Exhibit 9

Special studies for the Montreal areas carried out as part of the CUTA "Demographic Trends" study by Professor Robert Chapleau of the Ecole Polytechnique de Montreal, tracked changes in the travel behaviour of males and females by age, over time and related changes in labour force participation. These conclusions, which have been confirmed in subsequent studies,[12] suggested that male car ownership in Montreal is approaching saturation, while women's auto ownership is increasing sharply, especially for those living in suburban areas.

O-D Survey Limitations and Implications

O-D surveys, like all surveys, have limitations as well as strengths. In-depth research, using detailed trip diaries, reveals that standard O-D surveys tend to under-report non-work and non-school trips, but they tend to capture most transit travel for work and school and other purposes (when survey results are compared to reported transit ridership). Therefore, O-D survey based estimates tend to understate actual daily transit ridership by up to 10%.

Furthermore, because O-D surveys typically focus on a single day, they suffer from the "frequency bias" problem identified by Oram Associates.[13] The

[12] See for example, Robert Chapleau, "Urban Mobility Market of Workers: Analysis with Georeferenced Data", Paper proposed for presentation to 77th Annual Meeting of the Transportation Research Board, January 1998. (July 1997)

[13] Oram Associates, March 1996, "Review of February 1996 On-Board Survey of LTC Riders."

frequency bias results from the fact that a person who rides transit daily will be captured in a one day survey while those who ride infrequently have a lower chance of being included in the survey. By adjusting on-board survey results to overcome the "frequency bias" implicit in one day surveys, one can estimate the size of the total market for transit – the number of people who actually use transit as opposed to the number of trips captured on a single day. As illustrated in Exhibit 2, the "corrected" estimates were adjusted, based on the stated frequency of use (trips per week), to estimate the percentage of the total transit market (all transit riders) that falls into each "frequency of use" group. The "unadjusted" values indicate the number of transit trips that each group makes.

Exhibit 2 - LTC 1996 On-Board Survey Tabulations (one-way trips)

Frequency of Use	Corrected % of all Riders	Unadjusted % of Transit Trips
1 or less trips/ week	32	5
2-4 trips per week	25	14
5-8 trips per week	21	27
9-10 trips per week	12	24
11+ trips per week	9	28

The LTC study findings suggest that transit is used by a much larger population than is indicated by O-D survey results, which also suffer from the "frequency bias" problem. The data shown in Exhibit 2 indicates that most transit users in London are infrequent riders. As shown, 32% of LTC riders in 1996 made less than 2 trips per week and 25% made 2 to 4 trips per week. Therefore, 57% of those persons who took transit accounted for only 19% of total ridership. On the other hand, the 9% of transit riders who made more than 10 trips per week accounted for 28% of total LTC ridership.

The LTC data suggests that O-D surveys will tend to overstate the importance of frequent riders (persons making 10 or more trips per week to travel to work or school) and O-D surveys under-estimate the number of irregular and infrequent transit riders. Transit needs to know more about these infrequent riders and the reasons why they ride. The findings of the LTC survey were used to develop a "deep discount" fare strategy for London that appears to have succeeded in attracting additional transit use among the large numbers of persons who are infrequent or irregular riders since 1996, although the average fare per rider has declined.

Attitudinal and other similar surveys that use recall to record past transit use over time, would not suffer from the frequency bias problem. However, as discussed in Section 3.2, attitudinal surveys appear to overstate ridership, compared to observed transit patronage, in that infrequent riders including students and seniors tend to overstate the number of trips they have actually taken in a given period.

3.2 Attitude Survey Perspective

The second perspective has been generally based on transit "attitude surveys" carried out using telephone interviews of individuals at home (one person per dwelling unit). This perspective starts by identifying those persons who use transit and classifying them in terms of how much they use transit or why they use transit.

Attitude surveys generally collect detailed information on transit use during the previous week (7 days) as well as socio-demographic profile data and extensive information on attitudes toward transit and the other modes. However, these surveys are limited by three factors:

- less accurate recall of travel behaviour than appears to be the case for O-D surveys;
- low response rates (typically less than 50%); and
- much smaller sample sizes (typically 1000 to 2000 individuals for an entire Census Metropolitan Area).

These factors may explain why Attitude Surveys and other similar national surveys, using the same survey methods (such as the **1998-4 Omnibus Report on Public Transit Issues**)[14] appear to overstate actual ridership and transit market shares by 30 to 40 percent.

Ridership Turnover

Depending on the period of time chosen, the proportion of the general population who has used transit varies substantially, as documented in the 1993 Mississauga Transit Market Survey (Insignia Marketing Research). This report suggests that whereas 74% of Mississauga residents had used MT in the past, the proportion who had used transit declines as the timeframe is shortened as follows:

TIME PERIOD	PERCENT WHO HAVE USED TRANSIT
Last 5 Years	65%
Last 12 Months	50%
Last Month	33%
Last 7 days	23%

[14] The Environmental Monitor, 1998-4 Omnibus Report - Public Transit Issues. Prepared for Canadian Urban Transit Association by Environics Research Group, February 1999.

This finding and the detailed findings of the Attitude Surveys that were reviewed all point to the high turnover observed among transit's customers, a characteristic that is not evident from the analysis of O-D survey data. As noted by Oram Associates:

> *"despite common perceptions of "choice versus captive riders" and overall stability of the transit market, transit ridership is actually rather dynamic in many ways. It has been found that most transit users ride infrequently and certainly not everyday, despite transit's natural orientation to daily commuting. Also, while overall ridership levels may be static or even when falling, many new riders are constantly drawn to transit. The characteristics of new riders differ markedly from those of longer-term riders or the "average" rider. The converse of the "constant new entrants" finding is that riders are also continually lost, again with identifiable characteristics. Riders particularly prone to turnover are younger, more affluent and more often male than the typical rider."*[15]

The high turnover rate among transit riders is an important feature of transit use by a large share of the population who rides for a period of their life out of necessity. They tend to leave transit when their personal or family circumstances allow them to obtain a driver's license and purchase a personal use vehicle. There is also an indication that transit riders sometimes take the big step of buying their own car out of dissatisfaction with transit.

Categorization of Transit Riders

The basic approach employed in Attitude surveys to describe transit "riders" distinguishes between light or occasional riders, at one extreme, and 'very heavy" or "heavy heavy" riders, at the other extreme with "medium" riders in the middle. However, there is little agreement on what level of ridership constitutes light, medium or heavy ridership.

No matter what the specifics of the classification, heavy or heavy-heavy riders are usually "captives" in that they do not drive or do not have access to an automobile. Therefore, heavy riders tend to have the socio-demographic attributes of so-called "captives" in terms of age (15-24 are over-represented), gender (women are over-represented), and this group tends to have low incomes. Heavy riders also include persons who have access to a car but, for other reasons, choose to use transit. Unfortunately, the attitude surveys that were reviewed did not describe the travel characteristics of the heavy riders who chose to ride transit. It would be useful to know where these individuals live and work, for example. The general transportation literature suggests that this group most likely works in the CBD or inner city, or travels to some other area where parking is limited and expensive (such as a University Campus).

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[15] Oram Associates, March 1996, "Review of February 1996 On-Board Survey of LTC Riders", p. 3

A basic classification that is referred to in Attitudinal Surveys is the distinction between "captive" and "choice" riders. The definition of "transit captive" employed in Attitude Surveys is not always consistent with the definition suggested in the Section 3.1[16] and, therefore, the estimates of the levels of captive and choice ridership are not consistent with estimates developed based on O-D survey data. For example, the **1994 Edmonton Attitude and Awareness Survey** by the Angus Reid Group states that 59% of current ET riders are choice whereas 41% are described as "captive." Transit captives are described as "...those who would find it impossible to get where they need to go or who would have to go somewhere else if transit were not available."[17] Given this definition for "captive riders," choice riders include persons who can walk or get a ride to their destination.

O-D survey results suggest that most daily trips are made by persons who do not drive or do not have access to a car for their trip. For example, the US National Personal Transportation Survey results suggest that 70% of all the linked transit trips made in the United States in 1995 were made by persons who did not have a driver's license or lived in a household that did not have a car.[18] In Canada, the proportion of transit trips accounted for by persons who cannot drive or who do not have a car available for their trip, ranges from a low of 60% for the largest Metropolitan Central Cities to more than 70% for smaller cities and suburban areas in the larger cities.[19]

While the Attitude Survey approach considers attitudinal and value factors, in attempting to explain mode choice behaviour, most reports ignore the locational and personal factors than largely determine mode choice. For example, persons who do not drive (no license) or do not have a car available, or persons working in the central business district (CBD) who are more likely to be "choice riders," are not identified in interpreting choices or attitudes.

The re-analysis of 1986 TTC Attitude Survey data controlling for auto access and employment status (work full time, part-time, student and not-working) and trip purpose, revealed generally consistent results as those reported based on O-D survey data.[20] However, the attitude survey reported much higher mode shares than indicated by the 1986 TTS (O-D) survey: 38% average transit share for work trips compared to about 27% for TTS, including 23% for full time workers with

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[16] The demand modelling definition focuses on ability to drive and access to an automobile for personal travel.

[17] "1994 Edmonton Attitude and Awareness Survey", 1994, The Angus Reid Group, page 13.

[18] Public Transit in America: Findings from the 1995 Nationwide Personal Transportation Survey (September 1998), Center for Urban Transportation Research (CUTR), University of South Florida. Page 5-1.

[19] For example, 73% of respondents to a Saskatoon Transit on-board survey (which excluded school specials) reported that they did not use a car most-often to get around and were presumably "captive".

[20] 1986 Special Tabulations, 1985 TTC Attitude Survey

cars (and 81% for workers without cars). These results are consistent with the overstatement of total transit ridership compared to farebox based estimates of total ridership. It appears that transit users, especially those who use transit for other purposes, are more likely to respond to surveys about transit, which biases the results.

3.3 Conclusions: Profiling Riders and Potential Riders

Despite the apparent differences between the perspectives considered in this project, the available research consistently points to the importance of individual and household characteristics in defining current transit users. For example, persons aged 15-24, and women are more likely to ride transit than others. In the United States, minorities and immigrants are more likely to ride than the average citizen. Persons aged 35-44 are least likely to use transit, all other things being equal. The over-riding distinction between riders and non-riders, however, is between persons who do not have access to a car (no license, no car in their household, or no car available when they want to travel) and those who have a car. Persons age 15-24 and women are least likely to have access to a personal use vehicle, while person 35-44 are most likely to have access to an auto. Persons who do not have access to car are transit's best customers because they are "passenger captives" but they are not captive to transit, necessarily. As noted in the transportation literature, persons who travel downtown to work or school are also much more likely to ride transit, even if they can drive and have access to an automobile.

The review of the literature suggests that there are three basic non-service factors that can be used to stratify travellers and their trips and profile transit riders or potential transit riders:

- vehicle access/availability;
- destination land use/location (for a person's workplace, school location or other major travel destination); and
- origin or residential land use/location.

Three additional factors also influence trip making and mode choice behaviour:

- age/stage of life cycle
- employment status (full time work, part-time work, student (full or part-time), other (housemaker, retired, unemployed)
- level of transit service between major trip destination and home (quality of the transit connection between a person's origin and destination)

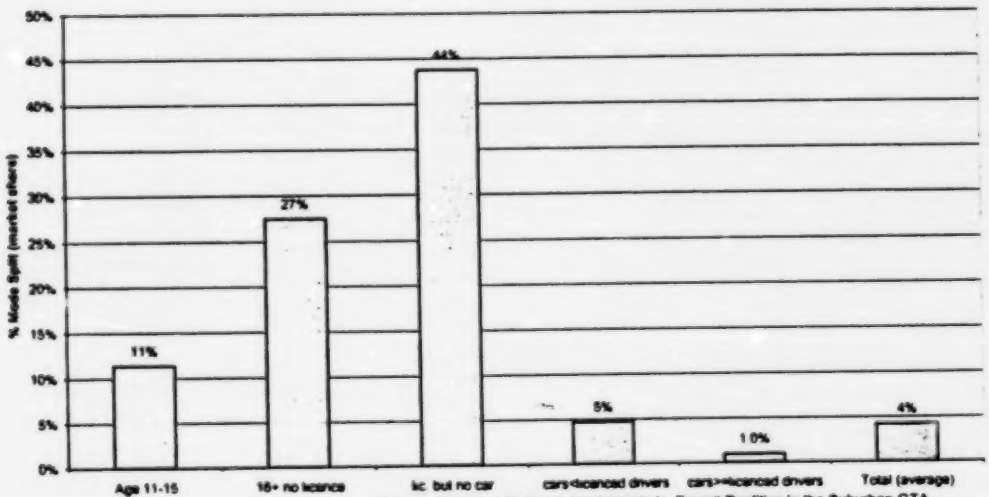
Vehicle Access

Vehicle access appears to be a fundamental criteria for stratification and the most important single factor in explaining variations in transit use. This conclusion is supported by the O-D survey and Attitude Survey data reviewed.

The importance of vehicle access is shown in Exhibit 3 which presents data on variations in local transit mode shares among persons living in the Suburban Greater Toronto Area[21] who differ in terms of their ability to drive and their access to private transportation.

The average local transit mode split for weekday travel by the residents of this suburban area was 4 percent in 1996. As shown, there are wide variations in transit use depending on age and auto access. Local Transit's best customers in the suburban GTA (in terms of market share) are persons who are licensed to drive but do not have access to a vehicle. Forty-four percent of the small population of suburban residents who are in this situation reported using local transit. The next largest transit mode splits apply to persons 16 years of age and older who do not have a license. This group is most likely to be auto passengers but 27 per cent use local transit. Persons aged 11-15, who cannot drive, are usually auto passengers in areas with high car ownership, such as the Suburban

Exhibit 3 - Market Shares for Local Transit Considering Driver's Licensing and Vehicle Access (1996)
(Suburban GTA excluding GO Rail passengers who use local transit)



Source Based on Exhibit 6, local transit, in Transit Realities in the Suburban GTA, November 1998, Data Management Group, University of Toronto.

[21] This area includes the Regional Municipalities of Halton, Peel, York and Durham.

GTA, but 11% use transit. Among those persons who live in households where the number of cars is less than the number of licensed drivers the average transit mode split is five percent. For persons who live in households where the number of cars is equal to or greater than the number of licensed drivers, the average transit mode split is only one percent.

Change in vehicle access is given as a reason for the high turnover that is observed among transit's customers. Attitude survey data suggests that poor service experiences can contribute to the decision of so-called "captives" to change their status by obtaining a driver's license and investing in an automobile.

As shown in Exhibit 4, the horizontal Auto Access/Availability dimension ranges from "passenger captive" at one extreme to "auto dependent" at the other extreme. Between these two extremes are people with various degrees of modal choice, depending on their access to personal transportation.

Passenger captives are dependent on transit or family, friends and co-workers for their transportation and, therefore, their use of transit will depend on service levels and convenience, relative to the available alternatives. In contrast, "auto dependent" persons require their vehicle as a condition of employment or because they transport other people. For this group the car is available for all trips, with rare exceptions such as mechanical breakdown.

The choice group includes persons who can drive but do not always have access to a vehicle (in households where the number of licensed driver's exceeds the number of automobiles) as well persons who drive and always have a car available.

It is important to identify "passenger captives" so that service and marketing strategies can be designed to encourage these customers to use transit more and to remain customers longer (by delaying the purchase of an automobile). This group tends to be over-represented in lower income inner city and suburban neighbourhoods but is present in all neighbourhoods to a greater or lesser degree in that persons under age 16 cannot legally drive and many seniors do not drive.

Passenger captives are not a homogeneous group. Their use of transit will vary depending on location, employment status and age/stage of the life cycle. This group includes so-called heavy riders (often persons working or studying full time), medium riders (for example younger people working or studying part-time), and light riders who are not in the labour force and are not highly mobile, such as retirees or the unemployed. Persons who can drive but do not have access to car at all times are also included among the light or infrequent riders. While such people are not always passenger captives they are also not "choice" transit riders.

Non-Residential Trip Destination / Location

A second fundamental factor is the non-residential trip destination location (and related land use and transportation service characteristics). As suggested in Exhibit 4, which shows Destination Land Use/ Location on the vertical axis, this factor is independent of vehicle access in its effects on transit use.

Exhibit 5 illustrates how mode splits vary by trip destination for trips made by residents of the Suburban GTA. While the overall average mode share for transit (local and GO Rail services, in this case) is about 7%, there are wide variations depending on trip destination with the higher mode share, by far, being for Toronto's Central Area (which includes the Downtown Core or CBD, as well as the Mid-town and University of Toronto). The only other destination with above average ridership are described as inner city/inner suburbs, the area largely developed before World War 2. This factor combines the effects of land use (density as it affects transit access and the competitive position of transit), and level of transit service. The CBD and wider downtown have the highest levels of transit service and transit access, and it is here where transit and the auto compete on even ground. The older inner city districts have above average levels of transit access and service and tend to have limited parking opportunities.

The CBD or Downtown Core stands out as the major transit destination in most Canadian cities – the destination where transit can be competitive with the auto. This is the major area that attracts "choice" riders, those persons who can drive and do have access to an automobile. Factors such as limited and expensive parking combined with good transit access and frequent service makes transit competitive. The CBD also attracts many passenger captives including transit patrons and persons who walk or get rides with family, friends or co-workers. In major cities this group includes people who never learned to drive and those who choose not to own a car. Such people have remained transit users because they have acceptable options (including walking, using transit for longer trips and, in some cases, renting cars for those occasional trips that require the use of a car).

The TAC "Urban Transportation Indicators" report[22] shows AM peak period transit mode share of more than 50% for the Toronto and Montreal CBDs, and mode shares of 30 to 40% for the CBDs of Winnipeg, Calgary, Edmonton, Ottawa-Hull and Vancouver. Saskatoon, an auto oriented Western city with a surplus of inexpensive parking, achieves a reported AM peak period modal share of 17%.

[22] Urban Transportation Indicators, Transportation Association of Canada, December 1999.

Exhibit 4 – Ridership Implications of Auto Access and Destination Land Use

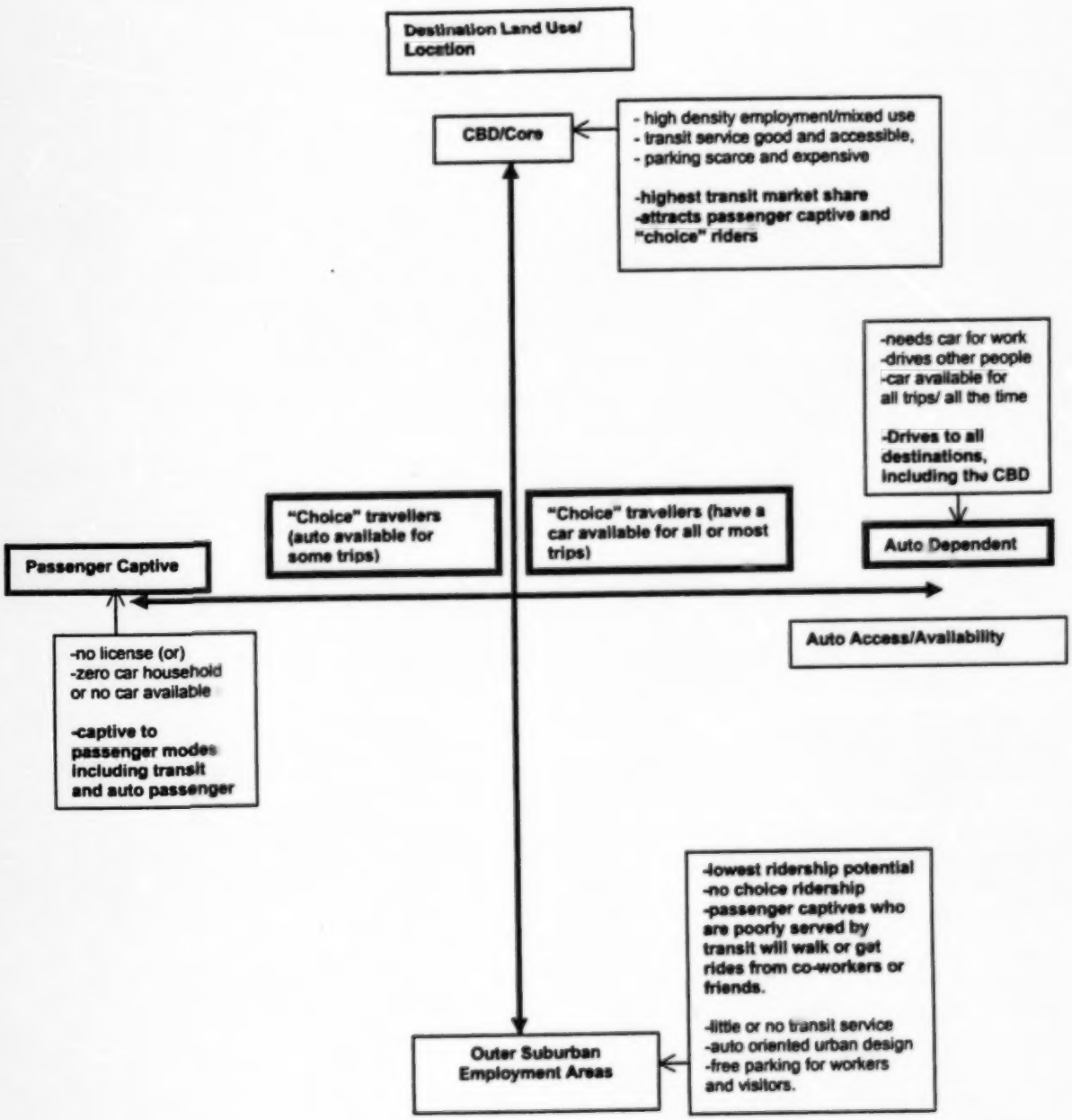
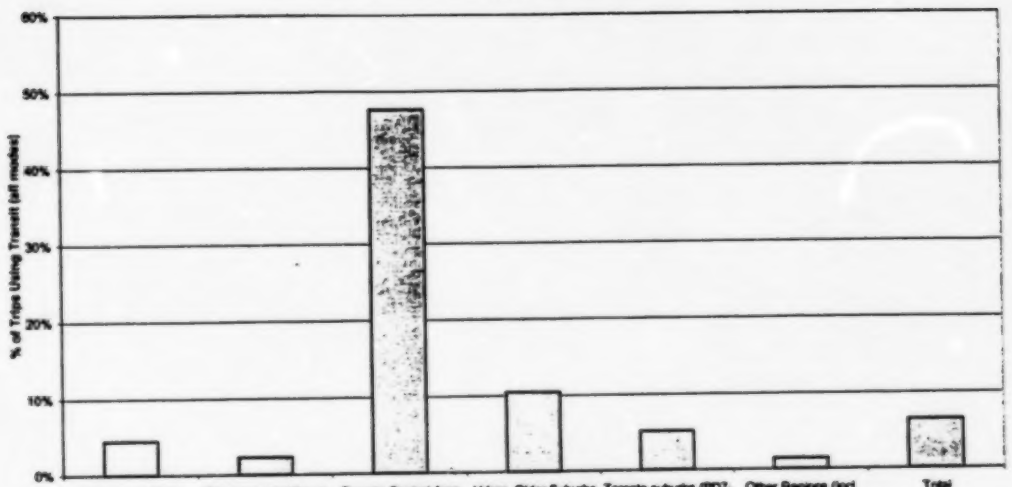

Destination Land Use/ Location
CBD/Core
- high density employment/mixed use
- transit service good and accessible,
- parking scarce and expensive
-highest transit market share
-attracts passenger captive and "choice" riders
-needs car for work
-drives other people
-car available for all trips/ all the time
-Drives to all destinations, including the CBD
"Choice" travellers (auto available for some trips)
"Choice" travellers (have a car available for all or most trips)
Auto Dependent
Passenger Captive
Auto Access/Availability
-no license (or)
-zero car household or no car available
-captive to passenger modes including transit and auto passenger
-lowest ridership potential
-no choice ridership
-passenger captives who are poorly served by transit will walk or get rides from co-workers or friends.
-little or no transit service
-auto oriented urban design
-free parking for workers and visitors.
Outer Suburban Employment Areas

Exhibit 5 - GTA Suburban Market Shares by Destination
1996



Source: Exhibit 4, Transit Realities in the Suburban GTA, November 1998, Data Management Group, University of Toronto.

Parking supply and price may well be a separate factor, in that is has been shown to have a direct influence on transit use, even in non-CBD locations such as post-secondary institutions or mixed use sub-centres, where these exist.

While other destinations do not have the advantages of the CBD, from a transit service point of view, many older neighbourhoods and secondary and post secondary schools do have similar transportation service characteristics including limited parking (sometimes paid parking) combined with good access to above average levels of transit service. These areas should be distinguished from suburban industrial or office park areas where parking is free and extensive and access to transit service is limited.

Trip Origin or Residential Characteristics

This dimension classifies residential trip origins in terms of population density and access to transit (a function of built form, transit service coverage and level of service). Different residential areas also have unique socio-demographic characteristics that also define transit potential in that factors such as income, occupation, education and ethnicity correlate with auto access/availability.

While trip origin is seen as being secondary to vehicle access and destination land use/ location, origin and destination have important transit service implications as suggested in Exhibit 6. Where travellers have excellent access to transit at their home and their workplace, they are much more likely to consider transit for their journey to work. In this case, the choice depends on the quality of the transit service connection between origin and destination.

In considering origin or residential areas it is necessary to focus on those geodemographic areas or clusters that hold the greatest promise considering auto access (passenger captives) and travel patterns (the proportion of local residents who are travelling to transit oriented destinations).

Trip making (total and by transit) is influenced by age/ stage of lifecycle and employment status as shown in Exhibit 7. The young and the old make few trips while the 35-44 age group, where labour force participation and family responsibilities are highest, consistently makes the most trips per day.

Independent of age, employment status also influences trip making. Those who are working full time make the most trips while those studying full time also make many trips, including regular trips to and from school. Part-time workers generally make fewer trips although the greatest difference is in peak period trip making – part-timers tend to travel in the off-peak. Retirees and other non-workers/ non-students make fewer trips in total and most of their travel is in the off-peak.

Exhibit 6 – Locational Factors and Transit Ridership Potential

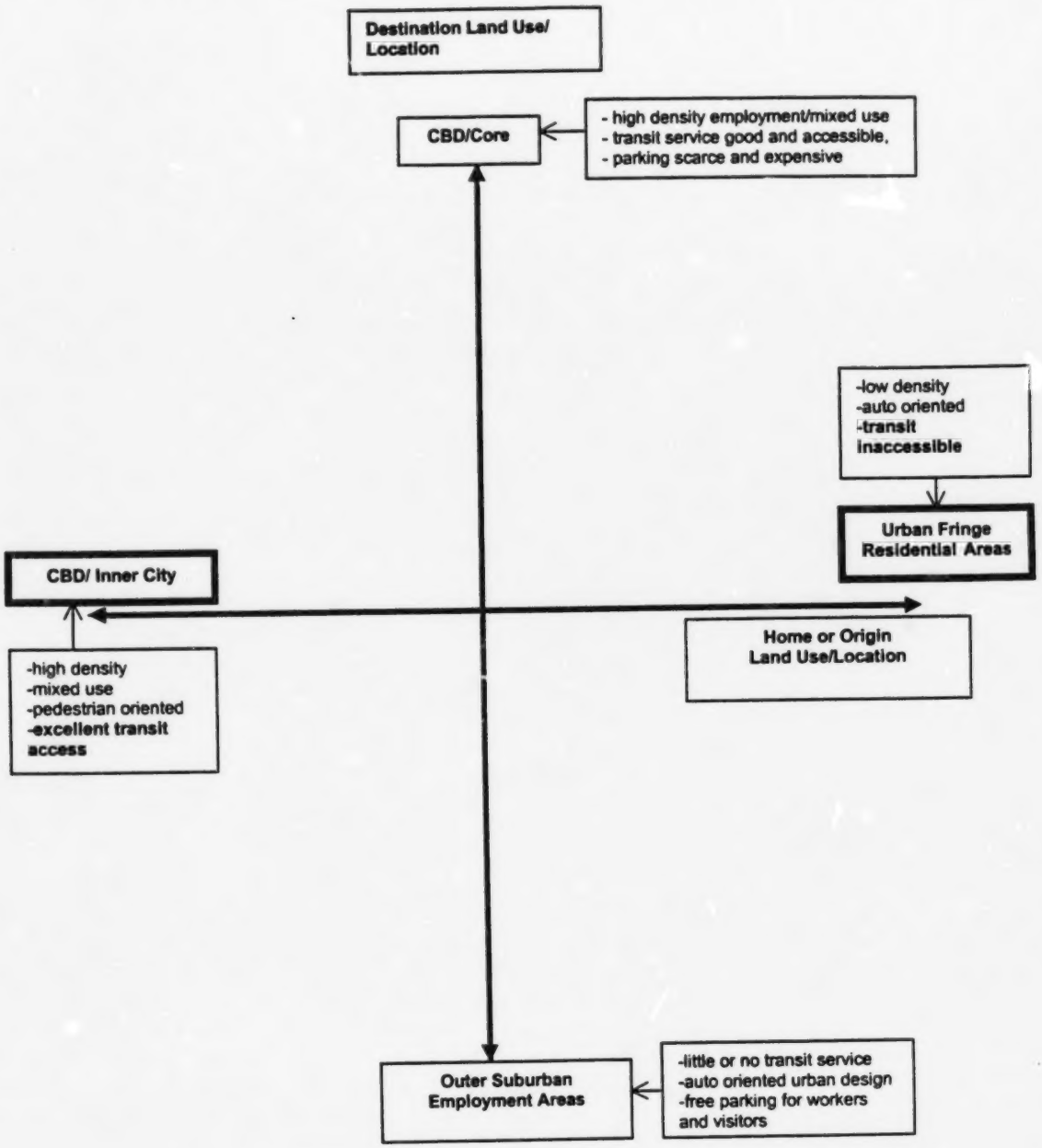
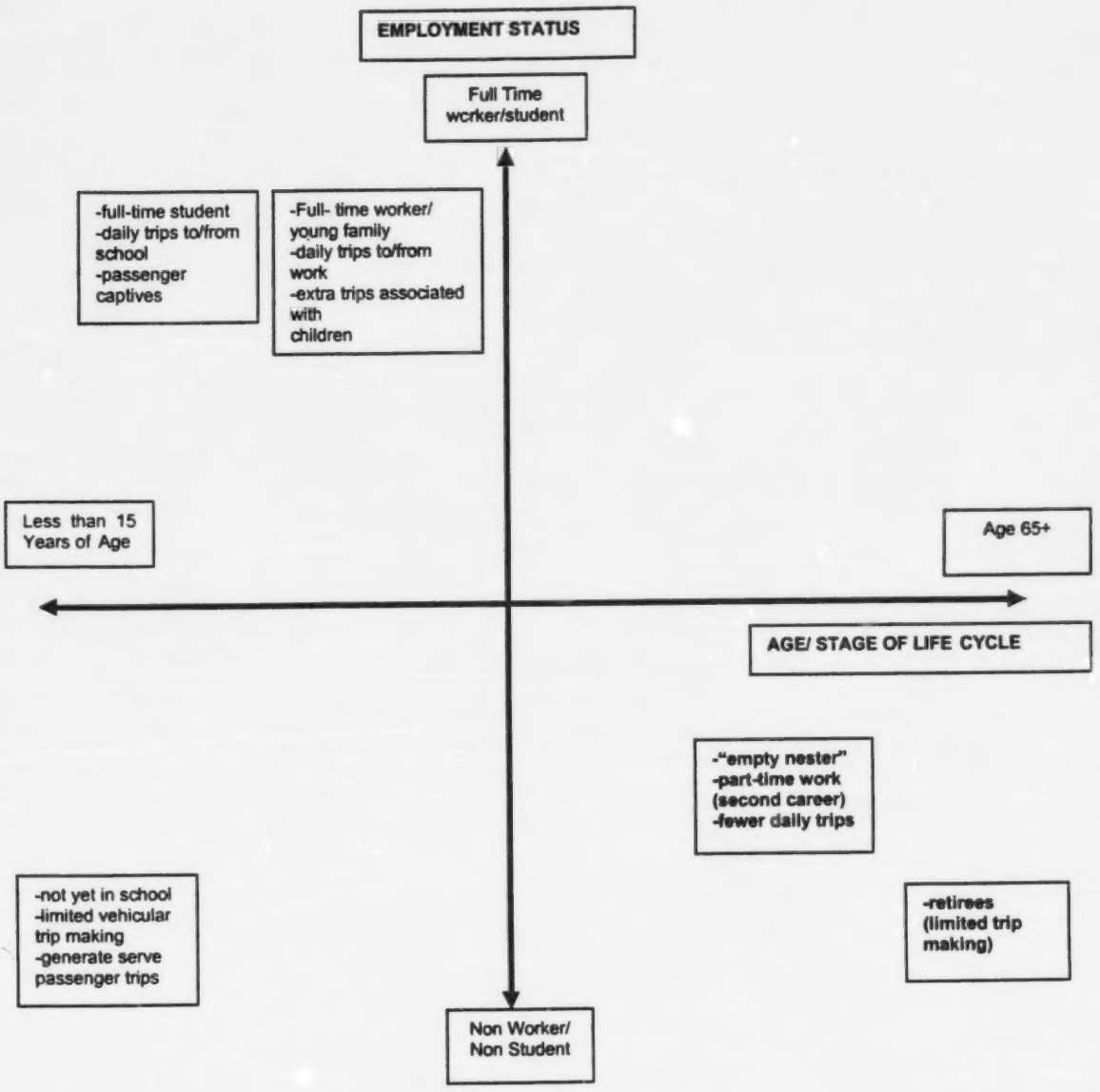


Exhibit 7 - Other Factors That Influence Trip Making



4.0 Synthesis: What We Know about Transit's Customers

Canadian cities continue to report higher transit use than US cities of comparable size due to higher levels of transit service, higher population densities, and a greater share of total urban employment in the downtown and inner city.[23] However, as argued by Raad and Kenworth in "Canadian Cities are going the way of their US counterparts into car-dependent sprawl,"[24] the reduced support for public transit by Provincial governments and lack of funding options suggest that the U.S. experience is directly relevant, particularly in growing suburban areas that are public transit's new frontier.

4.1 The U.S. Transit Market

Based on the National Personal Transportation Survey (NPTS)[25] 11.6 % of U.S. population used transit in the two months before the 1995 survey. Market penetration varies by size or urban area from 20% in MSAs[26] with at least 3 million to between 5% and 10% in small to medium sized MSAs and outside urban areas.

The U.S. transit market is "strongly dependent on captive riders." Captives, defined as those without licenses and those in zero car households, comprise 26% of the U.S. population 5 years or older. This group accounts for almost 70% of all linked transit trips (trips from an origin to a destination, including those that involve transfers to or from other modes or between transit modes) and 39% of those who use public transit at least once in a typical two month period.[27]

The decline in transit's market share, (over time) has been closely tied to the decline in the size of the captive market which, in turn, relates to the ageing of the population (relative decline of 15-24 age group), and the increasing availability of private vehicles.[28]

The US is approaching the saturation level with respect to auto ownership per licensed driver, worker and/or household. By 1995 the US had, on average, 1.78 vehicles per household, 1.34 vehicles per worker and 1.0 vehicles per driver.[29]

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[23] Tamim Raad and Jeff Kenworth, "The US and US" in Alternatives Journal, 24:1, Winter 1998, p.16, Table 1.

[24] Ibid, page 14.

[25] See for example, Public Transit in America: Findings from the 1995 Nationwide Personal Transportation Survey (September 1998), Center for Urban Transportation Research (CUTR), University of South Florida.

[26] Metropolitan Statistical Areas.

[27] Public Transit in America: Findings from the 1995 Nationwide Personal Transportation Survey (September 1998), Center for Urban Transportation Research (CUTR), University of South Florida, page 5-1

[28] Ibid, page 5-2

[29] Ibid, page 3-2

Given past and future declines in captive riders, this report states that transit's future will depend on attracting more choice riders.[30]

Density at both trip ends is another important factor in explaining variations in U.S. transit use because it relates to "level of service" and to other characteristics that favour transit including "pay parking, lower incomes and urban environments with sidewalks that tend to be associated with higher transit use."[31] Larger communities also have higher transit use, all other things being equal. This higher ridership appears to relate to the level of service provided and the provision of paid parking but not to variations in density.

Transferring is limited, despite the focus on "intermodalism". Seventy-nine percent of transit trips do not involve a transfer between transit vehicles, 18% involve one transfer and only 3% of transit users made 3 or more transfers. The transferring that does occur tends to be in larger urban centres and in higher density areas. The opinion/attitude components of the NPTS suggest that "Transferring does not seen to be a big problem relative to other problem areas people face in using public transit."[32] Crime, however, is identified as a much larger concern.

4.2 The Market for Transit in Canada

Despite differences between the O-D Survey and Attitude Survey perspectives on transit ridership, the available data suggests that the Canadian transit market is similar to the US market in terms of the importance of transit captivity and the impact of auto availability and land use factors. Recent studies in the Greater Toronto Area[33] and the Greater Montreal Area[34] confirm the importance of auto access in explaining variations in transit mode choice. The studies also point to the primacy of the CBD and inner city as transit destinations confirming the importance of land use factors (population and employment density), transit service levels and parking supply and price in determining the level of "choice" ridership. Two differences are important, however. These relate to auto access/ownership and the importance of crime.

Based on the US experience, Canadian cities generally have a long way to go before reaching saturation levels of auto ownership. Whereas the Regional Municipality of Ottawa-Carleton has one vehicle per worker, on average, and Toronto has less than one car per worker, the current US urban average is 1.34 cars per worker.

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[30] Ibid, page 5-1
[31] Ibid, page 5-2.
[32] Ibid, page 5-3
[33] Transit Realities in the Suburban GTA, Data Management Group, University of Toronto, November 1998.
[34] Robert Chapleau, "Urban Mobility Market of Workers: Analysis with Georeferenced Data", Paper proposed for presentation to 77th Annual Meeting of the Transportation Research Board, January 1998. (July 1997)

While crime is perceived to be a growing problem in Canada, it has not yet reached the levels seen in the United States.

Transit's major markets in Canada are defined by socio-demographic descriptors that correlate with lack of auto access. Heavy users tend to be aged 15-24, are disproportionately female and have low incomes. Often heavy transit users are recent immigrants. The factor that these groups share is lack of access to personal transportation choices. The strongest indicator of the likelihood of using public transit is auto ownership. This is not to say that transit does not attract riders who have a choice. Downtown is the primary destination for "choice" riders because this is where transit can be competitive, even in smaller cities. Parking availability and cost is an important feature of travel to downtown that exists in other areas of the city. Wherever parking spaces are limited, parking pricing is likely and transit has an opportunity to attract more riders. This is true for post secondary institutions, inner city hospitals and some suburban business parks.

With the suburbanization of population and jobs, auto ownership can be expected to increase and the size of the "captive" market will decline, as it has in the United States. Conversely, the choice market will continue to expand. People who are moving to new suburban communities or those who work in newer suburban employment areas increasingly see auto ownership as a necessity. This growing market will require improved services supported by attractive fare products and supportive marketing strategies.

Transit use varies by city and location within each city. As shown in Exhibit 8, factors such as the size of the CBD or Central Area, the availability of parking, auto availability and the level and types of transit service provided, all influence the levels of transit ridership achieved.

Exhibit 8 - Selected Data for Canadian Urban Areas

Canadian Transit Fact Book - 1998 Operating Data			1991 Urban Area Statistics - Kenworth and Laube**					
City/Transit Operator	Service Area Population	Rev Pass/Capita	% jobs in CBD	%jobs in Inner Area	Pop/Ha	Cars/1000	CBD Jobs (x1000)	CBD parking (x1000)
Toronto (TTC)*	2,385,000	163	13.7	47	42	606	174	30.6
Montreal (STCUM)	1,775,846	192	20	43	34	420	273	95.7
Vancouver (BC Transit)	1,633,911	76	13.4	41	21	565	104	46
Calgary	819,334	85	21	48	21	630	86.7	45.3
Ottawa (O-C Transpo)	660,700	107	24	38	31	510	82	25.6
Edmonton	648,284	65	19	?	48	526	63.2	37.5
Winnipeg	618,000	63	26	47	21	412	68.6	37.4

*Toronto's CBD is located within a larger Central Area that has over 400,000 jobs (including the 174,000 within the CBD)

** An International Sourcebook of Automobile Dependence in Cities, 1960-1990, Jeffrey R. Kenworthy and& Felix B. Laube, University of Colorado Press

Canada's largest urban areas, Montreal and Toronto, achieve the highest levels of transit use (rides per capita) and attract the highest level of "choice" ridership. Transit use in Montreal is higher, probably due to that city's lower auto ownership and the higher proportion of jobs in the CBD in Montreal, compared to Toronto. Transit in these established urban areas is used by a wide range of people for the widest range of trip purposes (because they offer the highest levels of service). However, as growth has extended beyond the boundaries of these

urban centres to the suburbs, and employment opportunities have become more dispersed, travel patterns and the markets for transit have undergone (and are undergoing) dramatic changes.

Land use and socio-demographic shifts have reduced the size of certain "choice" markets at the same time that traditional "captive" markets are also shrinking. For example, the loss of jobs in the inner city and the relocation of jobs to the outer suburbs has reduced travel to areas where transit has been traditionally competitive and increased the level of sub to suburb travel. At the same time outbound travel from the inner city and established suburbs to developing job opportunities is growing, creating potential increases in outbound commuting by transit, where appropriate transit services are provided. The major growth markets for transit in Canada's largest cities are long distance commuters who work in the CBD. These markets are well served by commuter rail in both cities.

Other large urban areas, including Vancouver, Ottawa-Hull, Quebec City, Winnipeg, Calgary and Edmonton are a mixed group in terms of rides per capita and types of service. While all these cities attract choice ridership to their CBDs, travel to other destinations is dominated by transit captives.

It will be important to try to understand how the ridership profiles of different cities vary considering gender, age and employment status and the degree of passenger captivity among transit riders. Differences in service design and level of service are another important factor. Quebec City, which is not shown in Exhibit 8, achieves 76 rides per capita per annum, a level which exceeds that of the larger cities shown on Exhibit 8, being equal to that achieved by Vancouver. Quebec was the first Canadian city to redesign transit services to satisfy the unique requirements of peak and off-peak riders and to attempt to capture increased commuter ridership oriented to major employment areas. The Quebec experience illustrates the benefits of designing peak period services that focus on those destinations where transit can be competitive. Quebec City's peak services were designed to compete with the auto for travel to a limited number of destinations, including the Downtown, taking advantage of bus-only lanes and other transit priority measures. In contrast, off-peak services were redesigned to maximize access and connectivity for passenger captives.

Smaller cities served by urban transit ranging from cities of 200,000 population (such as Saskatoon) to cities of 50,000 to 60,000 people (such as Whitby and Lethbridge) can have great differences in rider characteristics, even where per capita ridership is similar. For example, University students are the largest single group of transit users in both Saskatoon and Lethbridge, while they are insignificant in Whitby, where the largest single group of riders are transferring to and from the GO Transit commuter rail system. Community College students in both Lethbridge and Saskatoon are much less likely to use transit because they typically have their own cars/light trucks. Such local differences and possible explanatory factors (such as variations in service or the availability of discounted

University transit passes) should be reconsidered, in considering the differences in observed and potential ridership in different types of cities.

5.0 Conclusions and Recommendations

This section discusses the implications of the information provided in Chapters 3 and 4 for transit planning and marketing, and then provides some recommendations with respect to data collection and analysis, and areas for further researched.

5.1 Service Planning and Market Research Implications

Stratification

Mass transit's market is highly differentiated. Transit's product is evaluated in relation to the travel needs of individuals rather than the needs of a "mass market." Nevertheless transit riders must, of necessity, be grouped into a range of "niche" market segments for planning and marketing purposes. The awareness of the differences in transit ridership potential associated with different sub-markets is critical to the development of cost-effective transit strategies, and their promotion.

The research suggests that market segments be defined in terms of three primary non-service factors:

- auto access characteristics (captive/choice)
- main non-residential destinations, and
- residential land use/location.

The attitudes/opinions and values of existing and potential transit riders are best understood when these three primary non-service factors are used to define unique ridership sub-markets. The planning and marketing implications of attitudes and opinions will become more meaningful when survey respondents are stratified in terms of these dimensions, assuming that there are sufficient observations available for each unique sub-market. Effective stratification will, however, require the development of definitions of the relevant vehicle access and locational classes or market niches that are appropriate for each transit service area.

Secondary stratification factors that should be considered in the analysis of data for each primary market segment include **age** and **employment status**. These factors explain variations in trip making and help to further define niche markets for transit.

While the three primary factors (auto access, destinations, origins), used with the secondary factors of age and employment status explain ridership potential, the

level of transit service provided to each area is the major factor explaining current and future variations in actual ridership.

The Concept of Transit Captive

There are no long-term transit captives, especially if service is perceived as poor. Today's captives all have choices, for at least some of their trips. Services and related products should be tailored to the needs and wants of different types of captives so as to encourage longer term use and, where feasible, greater levels of use.

Considering both primary and secondary stratification factors, so-called transit captives are a diverse group. They can be stratified by degree of captivity (access to alternative modes), frequency of use and/or related socio-demographic characteristics (frequent, medium and light riders, where frequency varies with age and lifestyle).

Non-Residential Destinations

Downtown commuters and post secondary students are also diverse market segments which include various captive and choice sub-markets who use, or can use, a variety of different services including local bus, rapid transit or commuter rail in combination with auto or other transit modes. Major transit destinations such as the CBD, office sub-centres, universities (and any other areas where auto use involves inconvenience, delays and/or costs) should also be an important focus for service planning and marketing.

Residential Land Use/Location

At the residential end, the origin or destination of most transit trips, physical, social and transportation service characteristics will define neighbourhoods and corridors that have distinct levels of transit ridership potential. Planning and marketing activities should focus on the residents of transit-oriented communities or clusters (including suburban neighbourhoods that are underserved and strongly oriented, in terms of O-D patterns, to major transit destinations).

Implications for Service Development Process

In assessing the demand for specific services (e.g. the response to a given new service in a specific area), transit should consider a multi-faceted staged approach:

1) collect area-wide data, stratified according to the primary and secondary factors listed above,
2) analyze the stratified market segments,
3) develop the appropriate service design concepts / planning strategies, and

4) employ targeted market research in addition to normal public/neighbourhood consultation procedures to refine the concept prior to implementation.

Area-wide O-D survey data, where it exists, is an excellent source for stratified data; it can provide information on the primary factors: auto access, broad travel patterns between origins and destinations. It can be used for example to identify the percentage of trip origins destined for the CBD, University, or Community College, etc., as well as basic auto access for the geographic sub-markets of interest. It can also provide information on the secondary factors (age, employment status). Any knowledge gaps can be filled in using Census data on income, age structure, occupation etc., for Census Tracts. Where O-D surveys do not exist, it may be possible to gain sufficient information from properly structured on-board surveys or special-purpose destination-based surveys to focus on market segments of particular interest.

Given an understanding of travel patterns and transit potential, it will be possible to develop relevant service concepts including routing, running times (travel time for patrons) hours of service, schedule etc. The final step would involve sample surveys of residents of the proposed service area to assess attitudes/opinions prior to final design and trial operation.

5.2 Marketing Strategies

The research has identified two alternative marketing strategy approaches that transit systems may wish to pay more attention to depending on their individual context: 1) focusing on frequent riders, and 2) focusing on occasional riders.

Focusing on Frequent Riders

The "one to one marketing" approach suggests that transit systems should focus on their **"frequent flyers"**, i.e. their monthly or annual pass purchasers. More attention should be devoted to conducting market research that asks them what they want, and then designing strategies that appeal to their needs. This might include: tailored customer information, targeted promotional material, preferential treatment by other means (e.g. discount shopping coupons, preferential auto insurance rates, etc.). Such approaches could also be extended to other market segments, that offer the potential to join the ranks of "transit's frequent flyers" through carefully crafted tactics, building on the information gained from market research stratification (i.e. promising work, school, hospital destinations where there is underutilized transit capacity)

The one to one marketing strategy tries to encourage potential customers to first invest in a pre-paid periodic pass, and then works to retain them. It focuses on the lifetime value of each customer rather than the value of a one-time transaction. There is evidence that moving customers onto pre-paid media

reduces the perceived cost of the transaction, and thereby results in increased ridership.

However, the research has also found that there are high turnover rates among transit's customers; most of the population has used transit at some time but few continue to ride for long periods. This somewhat moderates the benefit derived from a "lifetime value" perspective of the transit customer.

Focusing on Occasional Riders

The second marketing approach that has emerged from this study, stems from the contention that most of transit's customers, with the exception of some segments commuting to the urban core where parking is expensive and difficult, are in fact **occasional riders**, who use the system infrequently. They subsequently leave transit (turnover) as they increase their ongoing access to an auto, to meet their mobility needs. Based on this perspective, transit should focus primarily on methods to encourage greater use of the transit system by this group of occasional riders. The preferred method of encouraging greater use of transit is through "deep-discount" fare strategies, which substantially discounts the pre-paid ticket price, as compared to the cash fare. It is argued that it is easier to encourage the occasional rider, who is already familiar with the system, to use the system more, than to attract regular auto drivers.

The finding that most urban residents who use transit do so infrequently poses a challenge for the industry. Deep discount fare strategies have had success in Canada (London) and several systems in the United States in attracting additional ridership from this group, but the new riders contribute less money per ride. If ridership per se is the prime objective, independent of the potential revenue/cost implications, then this may be an attractive marketing strategy. However, if revenue/cost considerations are an equally critical objective, which is the situation for most Canadian transit systems, then the uncertainties associated with this strategy would have to be carefully weighed. An ideal situation would be if a deep discounting strategy could result in the adding of new "off-peak" riders, at little or no additional cost. However, more research is needed to understand how market segments (using the proposed stratification) respond to various deep discount strategies.

5.3 Recommendations

The study has identified a number of recommendations related to: 1) enhancements for transit data collection and analysis, and 2) areas for future research.

Improving Data Collection and Analysis

- In designing and conducting market research (e.g. attitudinal surveys, on-board surveys, etc.) for purposes of service planning or marketing, transit systems should use more **stratification of riders**, and should base it to the extent possible, on the primary and secondary factors identified in this study. This may require a somewhat heavier investment in market research, because of the additional questions on auto access, origin and destination and the larger sample size that will be required. Nevertheless, the increased costs will yield information that will be of much higher quality and offer greater benefits. For example, it will provide information that can be used directly for service design purposes.

  The research has found that attitudinal surveys that are based on small samples and that characterize total ridership in general terms without detailed information on auto access, origin and destinations, are of very limited use in practice.

- Transit systems, especially large ones, should conduct surveys of **monthly pass holders** on a periodic basis, using travel diaries or other approaches. This is potentially a powerful tool for gathering better data about transit's preferred customers, the "frequent flyers", which in turn could be used to develop improved marketing strategies (e.g. related to pricing, convenience, promotion, etc.)

- Transit systems should conduct **surveys of major employers and universities/colleges** where O-D survey data are unavailable or out of date to obtain information on the travel needs of riders and non riders. Such surveys can often be conducted in very cost-effective ways with the help of employers and university/college staff. For example, residential postal codes can be obtained from employers and registrars, allowing for the geocoding of work and school trip origins. Also, students can be used to conduct surveys that are useful for transit planning as part of methodology courses. The data gathered can be used to identify major corridors of travel, and to determine the appropriate type of services to provide for these promising market segments.

Areas for Further Research

- This research has concluded that auto access is a critical factor in evaluating and designing transit services. The concept of "transit captive" is ill defined and misleading; rather one needs to consider the continuum represented by different degrees of access to an auto. However, there is a need for more research on the concept of the "**auto access continuum**", in order to gain consensus on common definitions of the various degrees of auto access, that

can then be used in surveys, analysis, and the development of demand models.

- There is need for more research on the issue of **rider turnover**, and **lifetime-value of a rider**. This would give a better basis for deciding on marketing strategies and cost-effective means for attracting and retaining frequent riders.

- There is finally a need for research to better understand experience with the concept of "deep discounting", and in particular how specific **deep discount strategies aimed at attracting more off-peak riders** might be designed.

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APPENDIX B
Profiling Transit's Customers - Alternative Approaches: A Working Paper

This interim report documents different approaches to profiling and understanding transit's customers and presents related data and insights. Section 1 reviews transportation demand modelling perspectives on who uses transit and why they choose to ride. This perspective looks at transit riders in the context of urban travel behaviour, based largely on Origin-Destination Surveys carried out as part of large scale Urban Transportation Planning Studies.

Section 2 reviews research carried out by or for Canadian Transit properties focusing on those people who actually ride transit. This section considers the transit rider typologies used in traditional transit Attitude Surveys for a range of Canadian cities.

Section 3 discusses the typologies used in other types of survey and/or market research that are to varying degrees applicable to public transit.

Section 4, Synthesis, attempts to summarize the material presented in Sections 1-3 and identify a limited number stratification variables that can be used to define existing and potential transit riders.

1. Transportation Demand Modelling Perspectives on Transit Ridership

The widely use description of transit's market share, as "mode split" reflects the methods used by transportation planners to forecast future travel demands by mode. Travel demand forecasting models were formalised in the late 1950s and early 1960s. The development of these planning tools was based on the extensive empirical investigations using data collected as part of large scale household origin-destination travel surveys conducted in large cities across North America during this period. These surveys asked respondents to describe their travel behaviour on the day prior to the interview providing such details as trip time, purpose and mode used. This behavioural information was related to socio-demographic and locational information for each sample household and person.

The early demand forecasting models described trip making in terms of the four elements of the travel forecasting process: trip generation, trip distribution, mode split and assignment. The term "mode split" refers to the percentage of person trips made using each mode and therefore "transit mode split" typically refers to transit's market share of all person trips made by auto or transit. The factors that influence mode split are recognised in the trip generation and mode split components of the typical forecasting model. For example, increased auto ownership/availability results in increased mobility (trip making) but reduced transit use, all other things being equal.

Travel demand forecasting also defined travel in terms of special purposes including home-based travel for work, school, shopping, personal business, social-recreation and other purposes (that is travel with one trip end being the home) and non-home based travel (involving two non-home ends).

Early View of Transit Users

Martin, Memmott and Bone (June 1961) [Principles and Technique of Predicting Future Travel Demand for Urban Area Transportation, MIT Report No. 3], in their "compendium of the presently available and utilized methods for predicting urban transportation demand" provides a good example of how early travel demand modellers described transit users and estimated future transit use.

This 1961 report states that:

> *"Mass transportation services three basic categories of trips:*
>
> 1. *Trip to and from the Central Business District.*
> 2. *School trips.*
> 3. *Other trips within the urban area."* (Martin, et, al, 1961, Page 115).

The authors note that the amount of travel by mode is influenced by three variables:

1. auto ownership,
2. intensity of land use and residential density, and
3. the relative cost of travel and time of travel by mass transit versus the auto.

They also state that when considering mode choice, trip makers (excluding walk trips) can be divided in terms of 3 categories:

1. those who must use an auto (often called auto captives);
2. those who can use either transit or an auto or some combination of both (choice riders); and
3. those who must use transit (so called "transit captives").

Transit Captivity

In early travel demand models, transit users were typically thought of as transit captives, except for travel to the CBD. A 1962 paper presented to the 41st Annual Meeting of the Highway Research Board by Louis E. Keefer, addressed the "Characteristics of Captive and Choice Transit Trips in the Pittsburgh Metropolitan Area.

This paper starts by noting that

> *"The choice between the automobile and mass transit in the Pittsburgh metropolitan area seems to be determined mainly by household characteristics such as car ownership, net residential density, and distance from the Golden Triangle (the central business district)."* (Keefer, 1962, p. 1)

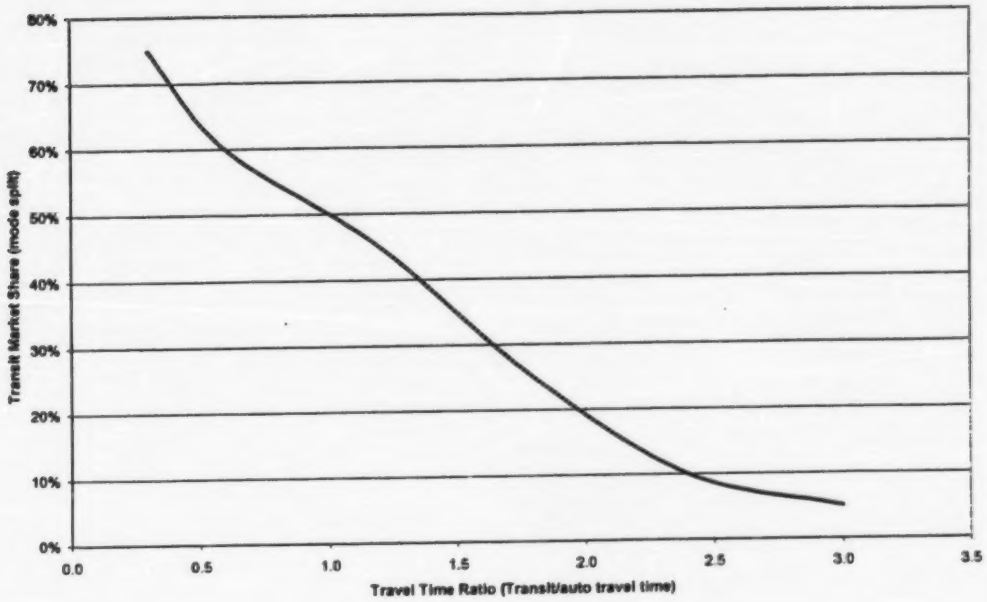
The analysis presented was based on a 1958 home interview survey that collected data on gender, race, age, occupation and details on the trips made by the residents of each sample household. However, the analysis was limited by the fact that this survey did not collect data on comparative family incomes, out of pocket travel costs, or attitudes.

Captives were defined as persons living in households that did not have a car and persons living in household with cars that did not have a car available for specific trips. For example, if the one car in the household had been taken by another household member, subsequent trips taken by family members would be defined as captive. If the car was available, but the next trip maker used transit, that trip was defined as a choice transit trip.

The Central Business District (CBD) - The Main Destination for Choice Riders

Given the importance of the CBD as the major transit destination, and the area that attracts "choice riders", transit trips to this area were often estimated separately in the early days of travel demand forecasting. Martin et. al. propose two methods for estimating future transit trips to the CBD: the auto ownership and residential density method and the travel time ratio diversion curve method. Both methods use observed (survey based) relationships between transit use and the relevant explanatory factors. Transit use in the 1950's was observed to generally decline with auto availability and distance from the CBD. It was also observed to decline as the ratio of time by transit versus time by auto declined. For example, where transit time was less than or equal to time by auto, mode splits of 60% to 75% were observed in the CBDs of major U.S. cities. These relationships were formalised using "diversion curves" that were summarized graphically, as illustrated in Exhibit 1, or mathematically to explain the choice between transit and auto.

Exibit 1- Sample Diversion Curve



School Trips

Transit use for school trips was seen to be largely restricted to people who were captive to transit, because they could not drive or were not eligible for yellow school bus service. Therefore, students living in multi-car households had the greatest opportunity of getting a ride and a lower probability of using transit. School trips by transit was thought to be best explained by variations in net residential density. (The actual exhibit referred to appears to be reversed in that transit use is shown to decline with increased density, which does not make sense).

Other Purposes

Transit use for other travel can be explained in terms of auto ownership, residential density and/or travel time diversion curves. The highest transit mode splits were observed for persons living in zero (0) car households, with transit use declining as auto availability increased. Transit splits for other trips also vary with residential density. At the high extreme, such as in older, inner city residential areas near the CBD, walk trips replace vehicular trips, resulting in lower transit use, compared to other inner city areas. As densities decline as one moves outward form the centre, transit use was also seen to decline. The effects of residential density on transit use are closely related to the fact that auto ownership also tends to increase as residential densities decline.

Predicting Transit Mode Split

Whereas the travel time diversion curve method recognizes the maximum potential mode split of between 60% and 80% for the CBD, where transit travel times are less than or equal to auto travel times, the maximum achievable transit share for non CBD destinations (for non school trips) is between 25% and 35% where transit travel times are less than or equal to auto travel times.

Martin et. al. also document an early theoretical model (by Warren T. Adams, "Factors Influencing Transit and Automobile Use in Urban Areas", Bulletin 20, HRB 1959) which predicted transit mode split (share of total person trips made by transit) based on population, transit service level (a factor that reflects revenue vehicle miles operated), economic conditions (work trips and auto ownership) and land use factors (related to distance from CBD). This early approach was the precursor to modern disaggregate modal choice models (such as the multinomial logit model) that purport to explain transit mode splits in terms of socio-demographic, land use/locational and transportation (auto and transit) level of service factors. These models are not restricted to the binary choice situations described by diversion curve methods (transit vs. auto) and can deal with a wide range of variables.

Later developments in modelling, as documented in John Shortreed (April 1989), "Transit Ridership and Mode Split Models" (prepared for The Seminar on Transportation Forecasting Technique, MTC, Ontario), focused on the influence of service and cost factors on transit mode choice, as measured by the transit modal split. For example, Shortreed notes that transit trip making, as measured by transit trips per capita (trip rates) varies with changes in transit fares, walking distance from transit route and the line-haul speed of transit services. The influence of these factors can only be seen when one controls for the effects of auto availability (to distinguish between zero car households, and one and two car households).

Shortreed identifies the following "key explanatory variables for transit ridership" considering three factors: land use, trip maker characteristics and trip characteristics, and the transport system:

1. LAND USE - population and employment (number and location)
2. TRIP MAKER – Income or car ownership, age/ stage of life cycle, priority in household vehicles, sex, status or occupation, number in party.
3. TRIP - Origin and Destination, Purpose, and Time of Day.
4. TRANSPORT – transit service available (freqency, fare, transfers required), Car and Road (availability, congestion, cost, etc.), walk, Car Pool, etc. (availability and cost).

Demand modellers also describe transit users in terms of trip purpose. As illustrated by the following table, transit use varies by trip purpose and between peak and off-peak times.

Profile of Mode Splits for the Toronto Area – 1964 (MTARTS).

Transit Mode Splits for 24 hours:

- home-based school (56%),
- home-based work (25%),
- home-based shop/personal business (14%)
- home-based social recreation/other (9%)
- non-home based trips (8%).
- Overall average 19%

PM peak hour transit mode splits:

- home-based work 28%,
- non-home based 18%
- home-based other 16%.

Source: Toronto Area Regional Model Study: Trip Generation, 1971.

Mode split models are choice models that allocate a given trip interchange between two three or more modes. The logit model, a widely used form of mode choice model, compares the generalized cost of each travel mode in estimating future modal shares. The "generalized cost" is the linear sum of the trip attributes that is weighted to reflect the relative importance of each attribute. (Shortreed, p. 20). For example, the generalized cost of the transit mode can include access time (walk time to and from a transit service), wait time (typically half the head-way), in-vehicle time (travel time while in a transit vehicle), a measure of service reliability, a measure of comfort and/or convenience, and the transit fare (the $ cost of riding transit). Typical costs considered for the competing mode (auto driver) are travel time, parking costs, and other out-of-pocket costs.

In estimating these generalized costs for transit, modellers have been able to estimate the relative importance of access, wait and in-vehicle travel times, in relation to transit fares. They have also been able to isolate the impact of parking costs and fuel costs on the perceived cost of the auto.

The Importance of Individual "Cost" Factors

The consensus of demand modellers is that walking time to and from transit is 2 to 3 times more onerous than in-vehicle travel time in relation to the perceived total cost of using transit. If the weight applied to in-vehicle time is 1.0, the weight applied to access time is 2.0 to 3.0 or more.[1] The comparable values for waiting and/transfer times range from 1.5 to 2.0. For the auto mode, walk time to/from parking is similarly weighted as being 2 to 3 times more onerous than in-vehicle times.

The linear, additive approach to assessing the influence of service factors on transit use that are used in the disaggregate multinomial modelling approach is logical and appears to explain variations in transit use, especially when socio-economic and locational factors are also considered. This method of predicting mode split is sensitive to policy issues related to transportation, transit and land use planning. However, this perspective on transit demand has been criticised as "not being derived from a theory on mode choice, but instead, a theory has been more or less adapted to the model". Verron and Martens question the assumption that the subjective utility of a transport mode alternative is linearly related to the attributes of that alternative or that the effects of these attributes are additive.[2]

Drawing on psycho-physics and the Gestault theory of phychology, Verron and Martens assess the efficacy of the Acceptance-Approach based on travellers subjective ratings of a range of objective characteristics of competing modes. This approach suggests that transportation options are perceived and evaluated as entireties and that the impact of specific factors are not additive. The results of this research demonstrate that combinations of favourable ratings, such as good access to transit at both trip ends and a direct public transit link between origin and destination results in a higher probability of using transit than the individual additive effects. Whereas the combined effects increase the probability of transit use by 18%, the individual effects of access and connectivity total to only 12%. (Verron and Martens, 1986, pp 144-145).

This approach to understanding mode split also points to the potential importance of factors like weather protection (at transfer locations) for public transport use, when other factors are favourable. For example, whereas favourable ratings on weather projection, access and egress walk times, and

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[1] Stephan Algers and Staffan Widlert reporting on "The Applicability and Stability of Logit Models in Sweden – Some Recent Findings and Policy Implications" (Behavioural Research for Transport Policy, pp 173-192, VNU Science Press, 1986) report that the relative weights for in-vehicle time, walk time to parking or bus stop and waiting and transfer times are: 1.0, 3.2, and 1.6. p. 177. Based on the review of a wide range of logit models, the authors suggest that the relative weights for in-vehilce,waiting, transfer and walk times be 1.0, 1.5, 2.0 and 2.0.

[2] See Hedwig Verron and Gerd Martens, "User's Reactions to Specific Combinations of Policy Measures" (Behavioural Research for Transport Policy, pp. 135-151, VNU Science Press, 1986).

transfer waiting times suggest a 24% change (from auto to transit), the summation of the individual effects is only 13%.

This research confirms the importance of reducing walk and waiting times and the number of transfers in encouraging choice riders to use transit. However, it questions the effectiveness of enlarging line-oriented services (rapid transit) with the resulting increases in waiting times and the number of transfers. Verrons and Martens suggest that strategies that the exclusive focus on reducing in-vehicle times will fail. Effective strategies must seek to develop a combination of favourable conditions recognizing the importance of access, connectivity and comfort/amenity factors.

Review:

The demand-modelling perspective on travel behaviour and transit use is based on large scale household surveys that captured detailed information on travel behaviour for a specific day (usually the day before the survey). O-D Surveys have been carried out for Canadian and U.S. cities since the 1950's with the most recent surveys carried out for Vancouver, the GTA (Greater Toronto Area including Hamilton-Wentworth), the MUCTC (Greater Montreal Area), and Quebec City during the 1990s. Other cities, such as Calgary, have also carried out household travel surveys, that differ in format, from the traditional O-D surveys, in that they ask more general questions about "usual" travel behaviour and are therefore, not directly comparable to the O-D surveys. However, they add details about week-end as well as week-day travel and transit use and use the same trip purpose and modal definitions.

This selective review of the travel demand modelling literature suggests a number of ways to classify transit trip makers and the trips they make, considering trip maker characteristics (income, age, gender, auto access etc.,), trip making charactristics (trip purpose, origin-destination, trip time etc.) and land use/transportation system characteristics (density, level of service, costs, etc.). This literature also points to the factors that influence trip maker's mode choices and the factors that must be considered in planning and marketing transit services.

Demand modellers started with the most basic distinctions between captive and choice riders based on auto access. As discussed, the analysis of O-D survey data showed that trip makers could be classified as auto captives, (need their cars for work or personal reasons), transit captives (no car available or cannot drive) or choice riders (have car available but can use transit). Experience suggests that transit captivity may not be an appropriate term – it would be better to think of persons who do not drive or do not have access to a car, as "passenger captives."

This early literature suggested that most choice transit riders were travelling to downtown, while passenger captives accounted for most other riders. Therefore, early demand modellers tended to classify transit users at being either CBD workers, students or others (a large residual category of persons that accounted for relatively few transit trips).

Subsequent modelling efforts have clarified the service and land use factors that influence transit use, highlighting the importance of access at both trip ends as well as the quality of the connection between trip origin and trip destination.

2. Traditional Transit Industry "Attitude Survey" Approach

The major market research activity carried out by transit properities in Canada, related to Attitude Surveys. According to the Canadian Transit Handbook - First Edition,[3] these surveys were originally carried out for two major purposes:

1. to determine the public's attitudes towards transit, to help design an advertizing campaign to correct "misconceptions" and to identify potential system improvements, and
2. to predict potential ridership in areas that are not served or when major fare, route or service changes are contemplated for an existing service.

Attitude surveys are also a source of information on the characteristics of current transit riders and the trips they make. Therefore, examples of Attitude Survey studies for a wide range of Canadian cities were examined to see how they characterised transit's customers.

The following section reviews data and reports prepared for Toronto, Mississauga, Edmonton and Vancouver.

Traditional Attitude Surveys often sort travellers into simple classes based on frequency of use and then profiles each class considering socio-demographics and attitudes.

The earliest Attitude Survey that was identified was the 1980 Public Attitude Survey carried out by Environics Research Group Limited for the Toronto Transit Commission (dated March 1981). This study was designed to update previous "attitude" surveys carried out by the TTC in 1976 and 1978. All three surveys were conducted by telephone with a representative sample of individuals.

One of the objectives of the 1980 survey was "to develop a profile of the characteristics and attitudes of TTC riders and non-riders in order to understand the reasons for use/non-use of the TTC." Another objective was "to determine

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[3] Published by the University of Toronto – York University Joint Programme in Transportation, in January 1980 (Editors, R. M. Soberman and Heather Hazard.)

market segmentation of the current and potential TTC market in terms of attitudes, behaviour and demographic characteristics."

The 1980 Public Attitude Survey Summary Report categorised survey respondents into five ridership categories:

- non-riders (0 transit trips in the last week and less than 4 transit trips in the average month)
- light riders (1-3 trips "last week")
- medium riders (4-9 trips "last week")
- heavy work riders (10 trips "last week")
- heavy-heavy riders (11 or more trips "last week").

Each group is described below.

Non-riders, persons who made no trips by TTC in the previous month, accounted for 43% of the survey respondents. They were primarily suburban residents, predominantly male, working full time and usually driving to work.

The remaining categories accounted for 57% of the Metro Toronto population.

Light riders accounted for 19% of the rider group (11% of the population). They were divided into three sub-groups:

- males and females working full time but using transit only for shopping and entertainment trips downtown;
- retired persons don't go out much and, therefore, use transit infrequently; and
- housewives who only use the TTC for shopping downtown.

Environics concluded that two thirds of respondents in the non-rider and light-rider categories "...would be unlikely to use the TTC because they need their car at work, get a ride with family and friends, work outside Metro, or need their car because they work odd hours or do shift work." Of the remaining respondents, it was estimated 11% would have low transit potential because they say that they prefer to walk or bike and 20% would have real potential to use TTC.

Medium riders (29% of riders or 17% of the population) were also categorised into three sub-groups:

- full time workers (male and female) but who do not use the TTC every day as their main mode of transportation;
- retired people who depend on the TTC; and
- people who walk to work but use TTC for their other trips.

Heavy riders accounted for 52% of all TTC users in 1980 or an estimated 30% of Toronto's population. This group was divided into "heavy work" and "heavy heavy" subgroups.

Heavy work riders use the TTC "almost exclusively" for home to work travel. Most heavy work riders work full time, a lower median age than the non-rider and light rider groups, and is disproportionately female and single. It was noted that the heavy work rider group was distributed in the downtown and the suburbs in the same proportion as the general population. Three sub-groups of heavy work rider were identified:

- Single persons without a car;
- Second income earner in a household with a single car;
- Other persons who have access to a car but "for other reasons" choose to use the TTC.

The "heavy-heavy rider" is more likely to be youthful, single and have a lower income than the other rider types. They are more likely to live downtown in an apartment or flat. This is the classic "transit dependant" group, referred in in the demand forecasting literature. This group uses transit predominantly for work and school related travel.

Considering all travel, the main reasons for using TTC on weekdays was work (51%) followed by school or university (13%), downtown entertainment (10%) and personal business (9%). More than half of all reported trips (52%) were made during the peak hours (7:00 to 10:00 AM and 4:00 to 6:00 PM). Sixty three percent of reported work trips were made during the peak hours whereas most shopping trips were made during the off-peak.

Transit use on weekends was described as follows: 27% for work, 20% for pleasure, entertainment and visiting areas outside downtown, 17% for pleasure and visiting in the downtown, and 11% for shopping downtown.

The 1980 survey found a strong relationship between auto access and TTC use: 74% of households with no motor vehicle available used TTC, compared to 40% for households with one vehicle and 28% for household with two or more vehicles. Sixty percent of medium, heavy work and heavy heavy riders reported that they use the TTC because they do not have access to a car. While 50% of medium and heavy work riders gave this as a reason, 73% of heavy heavy riders reported that lack of a car was the reason they used the TTC.

Gender as also identified as a factor in explaining variations in transit use. Whereas only 36% of males used TTC, 53% of females did so. The reason for greater female transit use related to auto access. Seventy percent of females cited lack of access to a vehicle as their reason for using TTC.

Other reasons for using the TTC included concerns about convenience (for travel in the city) and related convenience and cost issues (such as the cost of parking downtown and the fact that the TTC is "cheaper than driving".

The 1980 survey had a sample size of 1627 completed interviews representing 48% of potential responses. Ignoring non-response bias, this survey was thought to have a margin of error of 2.6% at the 95% confidence level (within 2.6% for 95 of 100 samples).

Data for subsequent TTC Attitude surveys are also available. These special tabulations of the 1985 Attitude survey include estimates of transit market shares for the various rider groups and by trip purpose. Data is also available that show the effects of auto access on transit use for full and part time workers, students and others. The estimates of transit market shares based on the available TTC Attitude Surveys tend to generate higher TTC market share estimates than other data sources (such as the TTS survey). Whereas the TTS estimate for local transit market share for all trips made by Metro Toronto residents was 25% for 1986, the 1985 TTC Attitude Survey indicates that the TTC market share is 35%.

Comparable Attitude Surveys have been carried out for many transit properties across Canada. The results of surveys for Mississauga, Edmonton, and Vancouver are reviewed in the following sections to identify similarities and differences with the 1980 Toronto results.

1986 Mississauga Transit Public Attitude and Ridership Survey (Feb. 1987) Environics Research Group Limited.

The 1986 Mississauga Transit (MT) Attitude Survey employed similar methods to those used for the 1980 TTC survey. The MT market segmentation used four groups: non-rider (no trips in last 4 weeks), light rider (1 trip per week on average but none in last week), medium rider (1 to 9 trips in last week) and heavy rider (10 or more trips in last week). Therefore, the MT categories are not comparable to those used in the earlier Toronto survey.

Each rider group had characteristic socio-demographics. The heavy rider group was described as being predominantly 15-24, single, low income, working and living in apartments (and having no car). At the other end of the spectrum, non-riders were described as disproportionately aged 35-44, working full time and having access to a car.

While 67% of the population surveyed had ridden MT in the past, the survey found that 75% of Mississauga residents (over age 14) were in the non-rider category, 8% were light riders, 11% were medium riders and only 6% were heavy riders. Car access was a major factor differentiating between the four groups: 71% of heavy riders could not drive (did not have a license or did not have access to a car). The comparable percentages of the other groups who did not

have access to a car are 56% for medium riders, 35% for light riders and only 7% for non-riders.

Age and gender factors were identified as explaining variations in transit use. Whereas 43% of persons aged 15-24 had ridden MT in the last week, only 12% of persons 25-34 had done so, and only 9% of persons aged 34-44. Thirteen percent of the 45+ age group had used MT services in the previous week. Whereas 80% of females had ridden MT, only 56% of males had done so.

Mississauga Transit Market Survey (August 1993),
Insignia Marketing Research

This later survey of Mississauga residents does not use the standard rider classification but, instead, focuses on demographic and trip making characteristics of MT riders by area of residence. Overall, 74% of respondents reported that they had used MT at some time, 65% in the last 5 years, 50% in the last 12 months, 33% in the past month and 23% in the last seven days. The 15-24 age group was most likely to use transit, as were persons with low incomes, students, persons with lower level occupations and persons doing shift work. Persons aged 15-24 (26% of the sample) accounted for 45% of total MT ridership over the previous 7 day period, according this report. In contrast, the 25-44 segment were reported to be least likely to use the transit system.

This study reported that the MT share of all reported trips was 18% (whereas the TTS survey suggests that transit's total share for trips made by Mississauga residents is less than 10%).[4] The modal share for school trips was estimated to be 41%.

Of all transit trips, 37% were for commuting to/from work, 20% to and from school, 18% for shopping, 3% for other business, and 20% for other purposes.

Attitude and Awareness of Edmonton Transit, 1989,
HLA Consultants.

This survey of Edmonton residents aged 18 plus also classified survey respondents as either non-riders (the 68% of the sample who had not ridden transit at all in the last 4 weeks) or as light, medium, heavy or very heavy riders (the remaining 32% of the sample). Note that 40% of non-riders indicated that they had used transit in the past "...on a regular or semi-regular basis."

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[4] Attitude surveys appear to generally overstate transit ridership and overestimate transit mode splits. For example, actual TTC ridership is up to 1/3 lower than the number that results when one uses Attitude survey results to estimate total daily or weekly rideship. It may be that transit users are more likely to respond to these surveys and this results in some overstatement of actual ridership. Note that Attitude Survey response rates are typically less than 50% (more than half potential participants refuse to take part or are not contacted).

In this study light riders made 1-8 trips using Edmonton Transit (ET) in the previous four weeks, medium riders made 9-24 trips, heavy riders made 25-40 trips and very heavy riders made 41 or more trips.

In Edmonton in 1989, the very heavy riders accounted for only 9% of all ET riders, heavy riders were 23% of all riders, medium riders were 32% of all riders while the light-rider category accounted for 36% of all riders.

Sixty-five % of Edmonton transit riders were female, according to this 1989 survey. Most ET riders (40%) were employed full time outside the home, while 21% were retired. Based on the survey 23% of transit riders were in the 25-34 age group, 21% in the 18-24 age group and 21% over 65 years of age.

The report compared the results of 1989 and an earlier 1981 Survey noting that whereas 32.5% of respondents in 1989 were transit users (had ridden in the last 4 weeks), this was down from 51.5% in 1981.

The major reason non-riders gave for not using transit related to the use of a private automobile. However, they did mention transit service issues as reasons for quitting.

In 1991, Edmonton Transit produced a report entitled **"Marketing Edmonton Transit to 2001"**, based largely on a reanalysis of the 1989 Attitude Survey. In this case 8 distinct "Transportation Segments" were identified based entirely on their modal choices. The 8 mutually exclusive segments included:

1. Public transit for all purposes (5.3% of population),
2. Public transit for discretionary trips (non-participants in workforce using transit for trips to other than work destinations). (11.7% of population),
3. Drive for all purposes (32.4%),
4. Drive for discretionary purposes (do not drive to work) (18.4%),
5. Drive to work & discretionary (minimal use of transit) (4.5%),
6. Drive to all except special events (20.9%),
7. Passengers for all purposes (5.2%),
8. Bike/walk/other for all purposes (1.7%).

The principal transit users are defined by segments 1,2 and 4. Each segment was described in terms of age, gender, employment status/occupation, residential location and main transit destinations.

Segment 1 is described as including, primarily, of middle aged women with part-time clerical jobs or students who live in inner city areas.

Segment 2 includes retired persons living in the inner city area in 1 or 2 person households. This group tends have low levels of education and to be predominantly female.

Segment 4 includes persons travelling downtown or to the University who again live in the inner areas and are predominantly female. About one third of this group works full time while 25% are retired.

1994 Edmonton Attitude and Awareness Survey
Angus Reid Group

This report provides a variety of perspectives on who rides transit in Edmonton. For comparative purposes, it summarize ridership for the same 4 groups identified in the 1989 study: Light-riders, medium riders, heavy riders and very heavy riders.

Whereas non-riders comprised 68% of the 1989 sample, this number had dropped to 52% in 1994 for reasons that are not explained. The biggest change that was noted among riders was an apparent shift from the heavy category to the very heavy category. Whereas only 9% of ET riders were in the very heavy category in 1989, 26% were so classified in 1994. At the same time the percentage of heavy riders declined from 23% to 9%. This report provides socio-demographic profiles for each rider group. For example, very heavy riders are typically younger than other riders, one out of two are students, or employed full time. Both the very heavy and heavy rider groups have limited access to cars, but two-third have a driver's license (and half have a car at home).

This report states that 59% of current riders are choice riders while 41% are described as captives (those who would find it impossible to get where they need to go or who would have to go somewhere else if transit were not available) Angus Reid Group, 1994, page 13). Most captives are women and one third are over 65. **The definition of choice riders appears to include persons who can walk or get a ride to their destination.**

The primary uses reported for Edmonton Transit are for transportation to and from work (32%) and to and form school (24%). The percentage of trips for work are lower than reported for other Canadian cities. For example, O-D survey data for Toronto and Montreal suggest that about 50% of transit trips are work related while about 20% are school related.

Former riders were also surveyed to assess their reasons for not using transit. Former riders were clustered in the 25-44 age groups and slightly more likely to be male than female. Former riders were also more likely to be employed full time and to have higher incomes than riders. The main reasons for changing modes included transit's perceived inconvenience (63%), car purchase / have access to a car (40%), and change in personal life situation (28%). Other factors

mentioned included service reliability (25%), comfort (15%), and lack of information, affordability and safety/security (less than 10% each).

B.C.Transit 1992 Usage and Attitude Study
Angus Reid Group

This survey divided the transit travel market into four usage groups defined in terms of the number of trips made as follows:

- Heavy (7+ times per week)
- Medium (1-7 times per week)
- Light (less than once a week)
- Non (have not taken transit at all in past two years)

Heavy riders, who use transit daily on average, were 13% of survey respondents in 1992 while moderate riders accounted for 24% or respondents, light riders (41%) and non-users (23%). The first two groups are referred to as "regular riders".

The Vancouver Area's heavy riders tend to be young, single, have lower incomes and live downtown, while non-riders tend to be full or part-time workers from higher income households, living in the suburban regions. While heavy rides are reported to be mobile, moderate riders are less mobile than light or non-riders. Heavy and moderate riders are most likely to use transit for work and school related travel than the infrequent and non-rider groups.

Infrequent or light users are described as those who "...use transit occasionally for entertainment, recreation, shopping and when the car is unavailable." (page ii).

The most common reason given for using transit "...is that people do not have alternate modes of transport (particularly true among women and Vancouver residents).

This report also proposes an alternative market segmentation strategy based on attitudes and behaviours related to travel and transit. These segments include three pro-transit groups that includes half the population: Captive Enthusiast (19%), the Timid Driver (18%) and the Cost Conscious Driver (13%).

There are also three other segments identified that are described as being "far less receptive to transit." They include the Demanding Driver (16%), the Autocentric (14%) and the Elitist Driver (20%).

The six segments are presented in order of their likelihood of using transit. Captive Enthusiasts are described as "...B.C. Transit's solid market." The Elitist

Driver and Cost Conscious Driver are described as "most likely to use transit under the right circumstances."

B.C. Transit Usage and Attitude Survey 1997
Cambell Goodell Traynor Consultants Limited

This report provides a summary of 1997 transit travel for the four groups of transit users defined in the 1992 study by Angus Reid, for comparative purposes. However, the study focuses on six user segments for the total population that focus on attitudes and transit use behaviour (as a basis for developing different strategies to attract greater patronage from across the GVRD population).

The following table summarizes the evolution of transit ridership in the Vancouver area with reference to the four traditional Attitude Survey user groups:

	1992 %	1994 %	1997 %
Heavy	13	15	14
Medium	24	22	20
Light	41	44	46
Non-Users	23	19	19

This suggests that there has been relative stability in terms of the size of each group with some movement from the non-user and medium user groups to the light user group.

This report notes that women tend to be heavier transit users than men while the young are the heaviest transit users. Persons aged 45-64 are most likely to be non-users and least likely to be heavy users. Students and persons with no vehicle available were the most likely to be heavy users.

The six alternative user segments were also defined in this study. They were referred to as:

1. Captives (do not have access to a vehicle),
2. Transit Advocates (express concerns about driving/traffic and find driving stressful),
3. Critical Transit Users (very time sensitive and negative in their evaluation of all aspects of transit service),
4. Grudging Transit Users (very busy, have to make many short trips),
5. Car Lovers, (very demanding/ transit does not meet their standards) and
6. Committed Non-Users (think transit is irrelevant) and are described as follows:

- Captives account for 25% of the population of the GVRD who do not have access to a car, van or truck. This group includes more women than men, are either under 25 or over 64.

- Transit Advocates account for 14% of the GVRD population and are the second most frequent riders, even though they make on average only 2.2 one way trips per week. They are generally employed full time and are concerned about traffic congestion and parking costs

- Critical Transit Users are 11% of the GVRD population, make 1.1 one way trips per week, but are very negative on transit.

- Grudging Transit Users, 15% of population and making .74 trips in past week, report the highest use of single occupant vehicles.

- Car Lovers are described as the second largest consumer segment, at 22% of the GVRD population, but rely on their cars. This group is average in terms of income and education.

- Committed Non-Users (15% of population) have the lowest level of transit use of the six segments.

3. Other Approaches to Profiling Transit Riders

The following approaches to describing transit riders have been suggested or may be applicable.

3.1 Market Opportunity Analysis

NCHRP Project 8-16 developed a "...descriptive, comprehensive, planning method...for the application of market opportunity analysis to the planning of short-range public transportation," as documented in NCHRP report 212 **"Market Opportunity Analysis for Short-Range Public Transportation Planning - Method and Demonstration"** (September 1981).

This project was an attempt to provide decision makers with concrete information on the probable utilization of service options by the various groups in the urban marketplace. It proposed a five step Market Opportunity Analysis (MOA) process including Public Transport Planning, Aggregate Community Market Analysis, Market Segmentation Analysis, Segment Mode-Attribute Preference Analysis and Segment Mode Concept Analysis. For the authors,

> *"The goal for the segmentation research is to identify groups within the community that appear likely to represent an opportunity for transportation services tailored to their needs. The end result of the segmentation step in the process is to identify promising, potential market segments that can*

be matched with a general mode system type likely to be competitive with modes currently being used (mostly the automobile)." P.11

A variety of market segmentation methods were identified in this report, including:

- Socio-demographic characteristics (age, gender, income, etc.)
- Travel choice constraints (vehicle availability, transit access)
- General attitudes (toward transit and auto)
- Attribute importance for transit service options/characteristics (used to explain mode choice considering service and cost aspects)

The authors go on to propose the use of standard statistical techniques such as cross-classification, factor analysis, and cluster analysis. to explore market research data and identify relevant market segments and define cluster profiles. Cluster (or market segment) profiles can consider the full range of attributes including socio-demographic variables, attitudes towards available modes, choice constraints, etc.).

Suggested criteria to select each segment are:

1. Size of segment
2. Geographic proximity
3. Likely receptiveness to a public transit service tailored to the segment
4. Technical and cost feasibility of implementing a public transit service likely to compete with currently used modes. Page 20.

The executive summary of this report noted that the suggested MOA approach may be impractical. The findings indicated that the potential public transit market was small, in relation to the total population. While up to 40% of transit non-users expressed some interest in trying an alternative, the required levels of service (to attract these transportation "leaners") was very high (and expensive).

Transit planners, when presented with the MOA results, including attribute preferences for the "leaner" group, tended to propose only variations on the exisiting fixed-route, fixed schedule transit systems, rather than the radical solutions that the authors had hoped for.

3.2. CUTA Social Trends Profiles based on socio-demographic segmentation considering employment status (worker, student, other), age and gender.

The CUTA study entitled " **The Implications of Demographic and Socio-Economic Trends for Urban Transit in Canada**" employed a market segmentation approach based on age, gender and employment status (worker,

students and all others) to compare variations in daily trip rates by mode for nine Canadian cities.

The CUTA study defined market segments in terms of age (15-24, 25-34, 35-44, 45-54, 55-64 and 65+), gender and employment status (worker, student and other). This approach to market segmentation took advantage of comparable O-D survey data available for Quebec City, the Greater Montreal and Toronto areas (allowing the comparison of transit and travel characteristics for both Inner Cities and large suburban municipalities in these areas) St. Catharines, Ontario and London Ontario.

The analysis documented in STRP Report #1-2 highlighted the unique relationship between age and mobility and the comparatively high use of transit by persons aged 15-24 and women of all ages.

Exhibit 2 illustrates how total trip making is highest for the 35-44 age group while transit use generally peaks for the 15-24 cohort. While women are less mobile than men (have lower daily total vehicular trip rates) they are transit's best customers, accounting for between 56% and 68% of weekday transit trips ten cities that were studied.[5] Women have higher transit trip rates for all age groups but lower total trip rates. The observed differences in trip making appear to reflect differences in driver's licensing and auto access.

Special studies for the Montreal areas carried out as part of the CUTA "Demographic Trends" study by Professor Robert Chapleau of the Ecole Polytechnique de Montreal, tracked changes in the travel behaviour of males and females by age, over time and related changes in labour force participation. These conclusions, which has been confirmed in subsequent studies[6] suggested that male car ownership in Montreal is approaching saturation, while women's auto ownership is increasing sharply, especially for those living in suburban areas.

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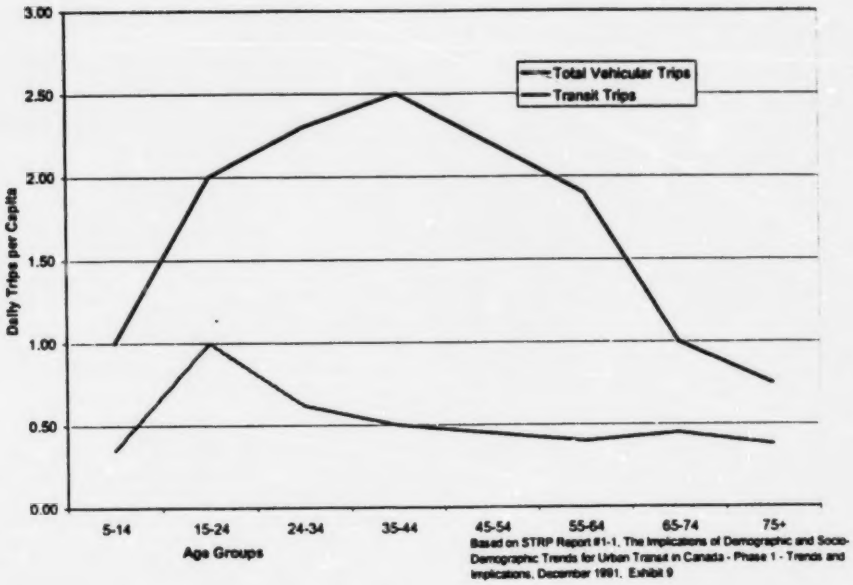
[5] See STRP Report #1-1, The Implications of Demographic and Socio-Demographic Trends for Urban Transit in Canada: Phase 1 Trends and Implications, page 15, December 1991, Prepared for the Canadian Urban Transit Association by Tranplan Associates and Environics Research Group Limited.

[6] See for example, Robert Chapleau, "Urban Mobility Market of Workers: Analysis with Georeferenced Data", Paper proposed for presentation to 77th Annual Meeting of the Transportation Research Board, January 1998. (July 1997)

Exhibit 2 - Mobility, Transit Use and Age



Based on STRP Report #1-1, The Implications of Demographic and Socio-Demographic Trends for Urban Transit in Canada - Phase 1 - Trends and Implications, December 1991, Exhibit 9

3.3 Advanced Market Segmentation

Neighbourhood Types

Geodemographic methods are used by market research organizations such as the Claritan (USA), Compusearch (Canada) and Experian (Europe) to describe national and urban markets in terms of neighbourhood types or "clusters". These clusters are given names such as "Suburban executives," "Mortgaged in Suburbia," "Canadian Establishment," and "Urban Gentry." The preceeding nicknames are used to characterize different types of affluent neighbourhoods in Canadian cities that have unique consumption characteristics.

Geodemographic clusters are derived based on "database-driven maps and statistical profiles"[7] that utilize Census data that describes the socio-demographic characteristics (income, occupation and education) augmented with other market research information on spending patterns for defined neighbourhoods.

Wiess describes the concept of clustering in terms of universal principles.[8] People tend to live with other people like themselves, resulting in relatively homogeneous neighbourhoods that can be described in demographic, lifestyle,

[7] Michael J. Weiss, The Clustered World, Little, Brown and Company, 2000, p. 3.
[8] Ibid, Appendix - The Universal Principles of Clustering, pages 305-308.

values and consumption terms. There is no mass market, but there is little connection between income and lifestyles or income and consumption patterns. Clustering responds to the need to identify niche markets by marketing products and/or services to target markets defined in terms of neighbourhood types and related consumption patterns.

Cluster based marketing is now used by private corporations to identify locations for new retail, banking or service outlets and by political groups to target direct mail campaigns. Given its geographical base, this technique may have some applicability to public transit.

Social Values Perspective (Psychographic Segmentation)

Environics Research Group (ERG) has an extensive Social Values database derived from over 15 years of survey research that has tracked trends in Canadians fundamental social values, beliefs, personal preferences and lifestyle characteristics. The 250 questions used in ERG's annual surveys are grouped into approximately 80 "trends" or "values" which are mapped using factor analysis of correspondence to suggest how various trends/values relate to each other and how these relationships are changing over time. These values can be mapped for specific socio-demographic groups or based on behaviour. For example, the values of business travellers and other travellers, segmented by age and/or gender, have been mapped in relation to fundamental values such as attitudes towards authority, social responsibility, ethics, importance of price, etc. This approach to market segmentation was utilized in conjunction with demographic segmentation, in a recent Environics/Tranplan study for the Greater Toronto Airports Authority, entitled "Socio-Demographic Trends and Implications for Airport Terminal Design, Requirements and Operations", July 1999.

TCRP Report 36 **"A Handbook: Using Market Segmentation to Increase Transit Ridership"** identifies psychographic segmentation as a strategy that could be useful in "identifying target markets," "better explaining consumer behaviour", "improving an agencies strategic planning efforts," and "minimizing the risks" for new services or products. However, this document also stresses that the data collection and analysis required to support psychographic research is expensive and there is "no guarantee that it will work."[9]

1996 London Fare Payment Pattern Study: Baseline

In 1996, Oram Associates carried out a fare policy study for LTC that involved an on-board survey that achieved an impressive 84% response rate utilizing a convenient "scratch off" survey card. The study report (page 3) noted that "recent transit research findings" indicate that:

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[9] TCRP Report 36 "A Handbook: Using Market Segmentation to Increase Transit Ridership," 1998, page 76

"despite common perceptions of "choice versus captive riders" and overall stability of the transit market, transit ridership is actually rather dynamic in many ways. It has been found that most transit users ride infrequently and certainly not everyday, despite transit's natural orientation to daily commuting. Also, while overall ridership levels may be static or even when falling, many new riders are constantly drawn to transit. The characteristics of new riders differ markedly from those of longer-term riders or the "average" rider. The converse of the "constant new entrants" finding is that riders are also continually lost, again with identifiable characteristics. Riders particularly prone to turnover are younger, more affluent and more often male than the typical rider."[10]

The survey findings on ridership and rider characteristics were adjusted to overcome the "frequency bias"[11] implicit in one day surveys in order to indicate the size of the total market for transit – the number of people who actually use transit as opposed to the number captured on a single day. The "corrected" estimates are adjusted, based on the stated frequency of use (trips per week), to estimate the percentage of the total transit market (all transit users) that falls into each user group. The unadjusted values indicate the number of transit trips that each group makes.

Frequency of Use	Corrected % of all Users	Unadjusted % of Transit Trips
1 or less trips/ week	32	5
2-4 trips per week	25	14
5-8 trips per week	21	27
9-10 trips per week	12	24
11+ trips per week	9	28

The LTC study findings suggest that transit is used by a much larger population than is indicated by O-D survey results, which also suffer from the "frequency bias" problem. Attitudinal and other similar surveys that use recall to record past transit use over time, would not suffer from this problem. However, as previously stated, these surveys appear to overstate ridership, compared to observed transit patronage, in that infrequent riders tend to overstate their use of transit.

US National Personal Transportation Survey (1995)

The National Personal Transportation Survey is described as "...the only authoritative source of national data on the amount and nature of daily personal travel in the U.S. and how travel has changed over time" (Our Nation's Travel: 1995 NPTS Early Results Report, September 1997, (page 2).

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[10] Oram Associates, March 1996, "Review of February 1996 On-Board Survey of LTC Riders", p. 3

[11] The frequency bias results from the fact that a person who rides transit daily will be captured in a one day survey while those who ride infrequently have a lower chance of being included in the survey.

Note that 1995 data "are not directly comparable to the 1990 and earlier NPTS's due to changes in methodology. The decision to employ a trip diary approach, as opposed to recall, and other survey improvements, resulted in more trips being reported in 1995 including more short trips and more trips for discretionary purposes (other than work or school). It is not clear how the available analysis (see, for example, **Public Transit in America: Findings from the 1995 Nationwide Personal Transportation Survey** (September 1998), Center for Urban Transportation Research (CUTR), University of South Florida.

Overview:

The U.S. transit market is "strongly dependent on captive riders" (CUTR page 5-1). Captives, defined as those without licenses and those in zero car households, comprise 26% of the U.S. population 5 years or older. This group accounts for almost 70% of all linked transit trips (trips from an origin to a destination, including those that involve transfers to or from other modes or between transit modes) and 39% of those who use public transit at least once in a typical two month period. (CUTR page 5-1).

The decline in transit's market share, (over time) has been closely tied to the decline in the size of the captive market which, in turn, relates to the ageing of the population (relative decline of 15-24 age group), and the increasing availability of private vehicles. (CUTR page 5-2).

The US is approaching the saturation level with respect to auto ownership per licences driver, worker and/or household. By 1995 the US had, on average, 1.78 vehicles per household, 1.34 vehicles per worker and 1.0 vehicles per driver. (CUTR pages 3-2).

Given past and future declines in captive riders, this report states that transit's future will depend on attracting more choice riders (CUTR page 5-1).

Density at both trip ends is another important factor in explaining variations in U.S. transit use because it relates to "level of service" and to other characteristics that favour transit including "pay parking, lower incomes and urban environments with sidewalks that tend to be associated with higher transit use." (CUTR page 5-2)

Larger communities also have higher transit use, all other things being equal. This higher ridership appears to relate to the level of service provided and the provision of pay parking but not to variations in density.

Transferring is limited, despite the focus on "intermodalism". Seventy-nine percent of transit trips do not involve a transfer between transit vehicles, 18% involve one transfer and only 3% of transit users made 3 or more transfers. The

transferring that does occur tends to be in larger urban centres and in higher density areas. The opinion/attitude components of the NPTS suggest that "Transferring does not seen to be a big problem relative to other problem areas people face in using public transit." Crime, however, is identified as a much larger concern (CUTR page 5-3).

Market penetration: 11.6 % of U.S. population used transit in the two months before the 1995 survey. Penetration varies by size or urban area from 20% in MSAs with at least 3 million to between 5% and 10% in small to medium sized MSAs and outside urban areas.

Transit Markets of the Future – The Challenge of Change TCRP Report 28 (1998)

This report documents differences in transit ridership for different strata of US urban society.

Table1 (page 8) provides indices of relative transit use (where the average metropolitan transit use is set as 1.0) which indicate the likelihood of using transit given variations in auto availability, income, ethnicity, age, immigration status and duration in the USA (for immigrants). Relevant indices of transit use are summarized in the following list:

- No car 5.74
- One + cars .68
- Men .85
- Women 1.18
- White .68
- Black 2.72
- Hispanic 1.73
- Asian 1.74
- Immigrant 2.08
- Non immigrant .84
- Age
  - 17-29 1.14
  - 30-39 .96
  - 40-49 .87
  - 50-59 .92
  - 60-64 1.07
  - 65-69 1.10

- Income
  - <$5K 1.23
  - $5-10K 1.24
  - $10-14K 1.08

- $15-20K 1.04
- $20-25K .97
- $25-30K .90
- $30-40K .78
- $40-50K .77
- $50-60K .84
- $60-70K .91
- $70K .95

Lack of auto access and those socio-demographic factors that relate to lack of auto access all suggest above average transit use. For example, persons living in zero car households use transit at almost 6 times the average rate of all urban Americans while Blacks use transit at almost 3 times the average rate.

This report tends to define potential markets for transit in terms of current usage patterns focusing on women, non-whites, immigrants, persons living in 0 car households, younger people (ages 17-29) and persons living in high density areas of major cities and those with low incomes. (see Table 3, page 17).

4. Synthesis and Interim Conclusions

Based on the review of the literature, as outlined above, there are two basic perspectives on transit riders that reflect the information sources and research purposes. The first looks at transit riders in the context of total travel, whereas the second focuses on the segmentation (or classification) of transit users.

4.1 O-D Survey Perspective

The first perspective builds on the availability of large scale Origin-Destination (O-D) surveys that are comparable over time and for different cities. Typically, 5% of area households are interviewed as part of these surveys and high response rates (70% or more) are achieved by pre-notification, and co-ordinated follow-up procedures. The O-D surveys collect travel data for all household members within sample households, focusing on the previous weekday.

This perspective has attempted to identify the factors that influence mode choice (between auto and transit), but is limited by the underlying data, which contains limited socio-demographic information and no attitudinal information . The CUTA market segmentation approach represents a re-analysis of O-D data, but takes the same perspective as the demand forecasters. In-depth research, using detailed trip diaries, reveals that standard O-D surveys tend to under-report non-work and non-school trips, but they tend to capture most transit travel for work and school and other purposes (when survey results are compared to reported transit ridership). Therefore, O-D survey based estimates tend to understate actual daily transit ridership by up to 10%.

4.2 Attitude Survey Perspective

The second perspective has been generally based on transit "attitude surveys" carried out using telephone interviews of individuals at home (one person per home). Attitude surveys generally collect detailed information on transit use during the previous week (7 days) as well as socio-demographic profile data and extensive information on attitudes toward transit and the other modes. However, they are limited by three factors: less accurate recall of travel behaviour than appears to be the case for O-D surveys; low response rates (typically less than 50%) and much smaller sample sizes (typically 1000 to 2000 individuals for an entire Census Metropolitan Area.) These factors may explain why Attitude Surveys and comparable national surveys, using the same survey methods (such as Environics 1998-4 Omnibus Report on Public Transit Issues) appear to overstate actual ridership and/or market shares.

This perspective starts by identifying those persons who use transit and classifying them in terms of how much they use transit. The basic approach distinguishes between light or occasional riders, at one extreme, and 'very heavy" or "heavy heavy" riders, at the other extreme.

While the Attitude Survey approach considers attitudinal and value factors, in attempting to explain mode choice behaviour, most reports often ignore the locational and personal factors than largely determine mode choice. For example, persons who do not drive (no license) or do not have a car available, or persons working in the central business district (CBD) who are more likely to be "choice riders" are not identified in interpreting choices or attitudes.

The re-analysis of TTC Attitude Survey data controlling for auto access and employment status (work full time, part-time, student and not-working) and trip purpose, revealed generally consistent results as those reported based on O-D survey data (1986 Special Tabs prepared for David Crowley based on 1985 TTC Attitude Survey). However, this source reported much higher mode shares than indicated by the 1986 TTS survey: 38% average transit share for work trips compared to about 27% for TTS, including 23% for full time workers with cars (and 81% for workers without car). It seems that transit users, especially those who use transit for other purposes, are more likely to respond to surveys about transit, which biases the results.

4.3 Conclusions: Potential Basis for Profiling Riders and Potential Riders

Despite the apparent differences between the two perspectives, both point to the importance of individual and household characteristics in defining current transit users. Persons aged 15-24, those who do not have access to a car (no license, no car, or no car available when they want to travel), and women are more likely to ride transit than others. Persons aged 35-44 are least likely to use transit, unless they work downtown and are well served by transit.

The review of the literature suggests that there are three basic criteria for stratifying travellers and their trips and profiling transit riders.

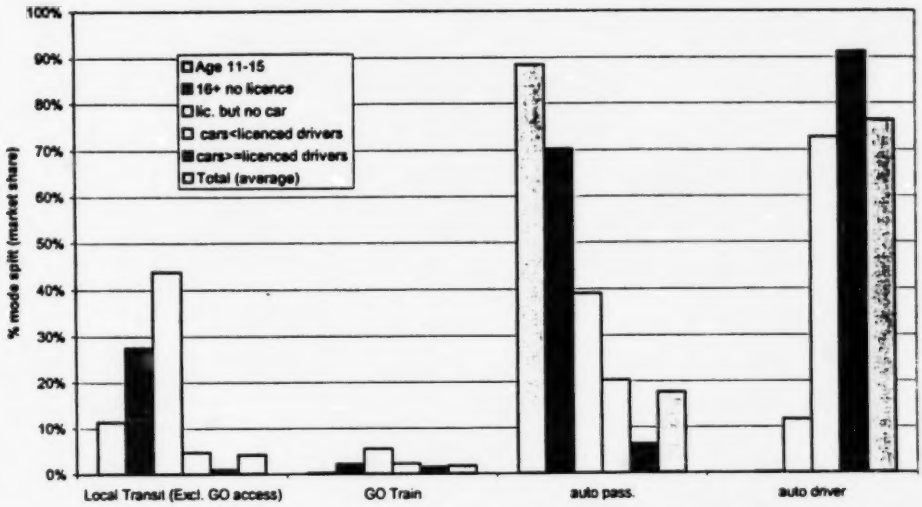
Vehicle access appears to be a basic criteria for stratification and the most important single factor in explaining variations in transit ridership and the potential to choose transit in the future. A second fundamental factor is trip destination location (and related land use and transportation service characteristics). The third dimension is trip origin and related land use and road and transit service characteristics. These points are discussed with reference to exhibits that were borrowed from a recent report entitled **"Transit Realities in the Suburban GTA"** (November 1998, Data Management Group, Joint Program in Transportation, University of Toronto.)

Car Access and Mode Choice

The role of car ownership and access in explaining mode choice and variations in transit ridership is illustrated in the following exhibits which are based on information for residents of the suburban "Greater Toronto Area" (GTA), the area outside of the new City of Toronto.

As shown in Exhibit 3, auto driver mode shares are highest for persons who live in households where the number of cars are equal or greater than the number of licensed drivers. Access to personal use vehicles (cars, light trucks, or vans) relates strongly to auto and local transit use but does not appear to have a strong bearing on GO Rail use, because many GO riders choose to ride the train rather than drive.

Exhibit 3 - GTA Market Shares by Mode Considering Availability of Driver's License and Vehicle Access 1996



Source: Exhibit 6, Transit Realities in the Suburban GTA, November 1998, Data Management Group, University of Toronto.

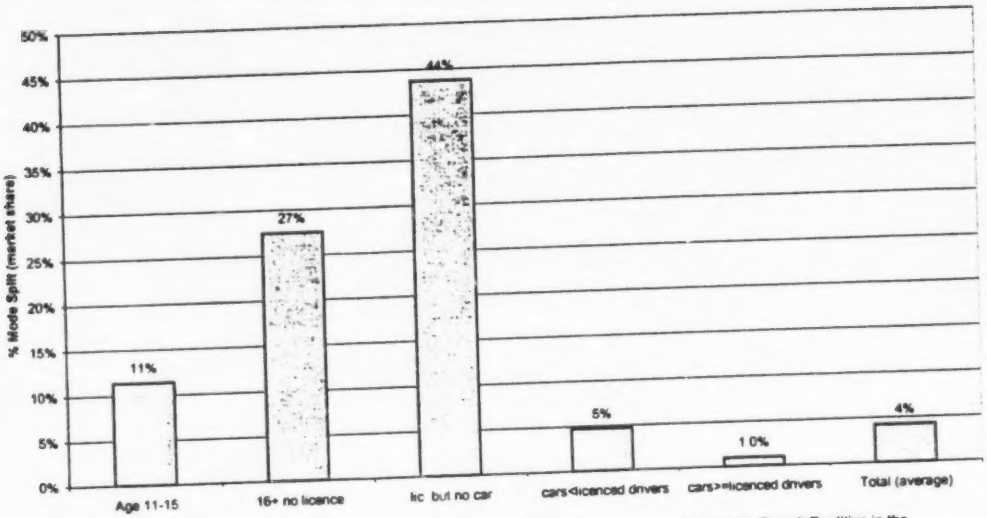
Exhibit 4 focuses on local transit mode shares. Note that the average local transit mode share considering weekday travel is about 4 percent. There are wide variations in transit use depending on auto access, however. Local Transit's best customers in the suburban GTA (in terms of market share) are persons who are licensed to drive but do not have access to a vehicle. Forty-four percent of the small population of suburban residents who are in this situation use local transit.

The next largest transit mode splits apply to persons 16 years of age and older who do not have a license. This group is most likely to be auto passengers (70 percent) as shown in Exhibit 1, but 27 per cent use local transit.

Persons aged 11-15, who cannot drive, tend to be auto passengers first (88 percent) and then local transit riders (11 percent). Among those persons who live in households where the number of cars is less than the number of licensed drivers the average transit mode split is five percent. For persons who live in households where the number of cars is equal to or greater than the number of licensed drivers, the average transit mode split is only 1 percent.

The various socio-demographic factors which can be used to profile transit users tend to correlate with auto access/ownership. These include, age, gender, and income, which is strongly related to auto ownership, except in older inner city areas which tend have lower car ownership at every income level.

Exhibit 4 - Market Shares for Local Transit Considering Driver's Licensing and Vehicle Access (1996) (Suburban GTA excluding GO Rail passengers who use local transit)

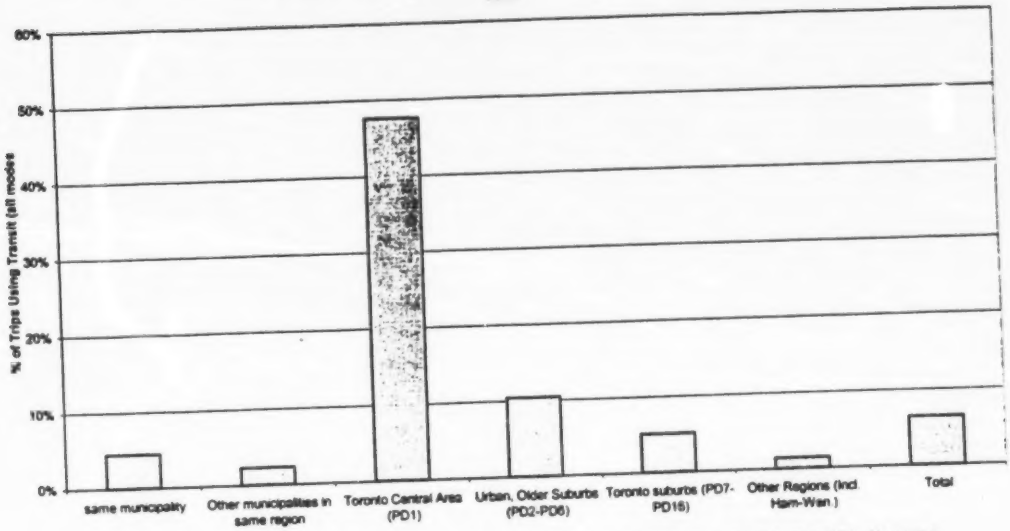


Source: Based on Exhibit 6, local transit, in Transit Realities in the Suburban GTA, November 1998, Data Management Group, University

Travel Destination

Exhibit 5 illustrates how mode splits vary by trip destination for trips made by residents of the suburban GTA. While the overall average mode share for transit (local and GO Rail, in this case) is about 7%, there are wide variations depending on trip destination with the higher mode share, by far, being for Toronto's Central Area (which includes the Downtown Core or CBD, as well as the Mid-town and University of Toronto). The only other destination with above average ridership are described as inner city/inner suburbs, the area largely developed before World War 2. This factor combines the effects of land use (density as it affects transit access and the competitive position of transit), and level of transit service. The CBD and wider downtown has the highest level of transit service, transit access, and it is here were transit and the auto compete on even ground. The older inner city districts have above average levels of access and service and tend to have limited parking opportunities.

Exhibit 5 - GTA Suburban Market Shares by Destination
1996



Source: Exhibit 4, Transit Realities in the Suburban GTA, November 1998, Data Management Group, University of Toronto.

Residential Location

Residential location and related socio-demographic, physical and transportation service characteristics including income, education, occupation, auto ownership, population density, access to transit and level of transit service, also influence the decision to use transit. Auto access and workplace location are important independent factors that determining the levels of "choice" and "captive" ridership. Regardless of location, low income persons with low car ownership are more likely to use transit out of necessity and persons working in the CBD are more likely to choose to ride transit. Furthermore, the residents of inner city neighbourhoods are more likely to use transit than are comparable suburban residents and residents of high density districts are more likely to choose transit than those living in medium density and low density areas, all other things being equal.